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The Southeast Queensland Ecological Restoration Framework – The 'how to guide' for a biodiversity hotspot

Tweed Byron Bush Futures Project: improving urban and peri-urban bushland sustainability in Tweed and Byron Shires

The use of mitigation planting to achieve strategic planning outcomes in local riparian restoration

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Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research, and diary dates are welcome. **The deadline for the September–November 2012 issue is Friday 10 August 2012.** The theme for the issue is **Landscape Restoration**. General articles are also very welcome. Specific examples of effective monitoring and general articles are also very welcome. Please contact Selga Harrington if you are intending to submit an article: selga.harrington@gmail.com.

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Front cover: The bushland around Bonnet Bay was protected following petitioning by local residents in the 1970s to prevent it becoming a tip. It now provides passive recreation for the community including 10 km of walking tracks. Photo: Huw Morgan. From article by Michael Harrington: A forty year history of Bushcare at Bonnet Bay, NSW.

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From the editor

Selga Harrington
Parsons Brinckerhoff

Welcome, readers, to the winter 2012 issue of Australian Plant Conservation! The theme for this issue is *Bushland Restoration*. This issue examines current small scale efforts and local approaches being made in the restoration of bushland areas. The next issue will expand on this to examine restoration at a larger, landscape scale.

As our population and urban areas expand, the pressure on our natural environment increases, bushland areas become degraded and suffer from weed invasion. Management and restoration of these degraded bushland areas has typically fallen to councils, community groups and individuals but is now also being undertaken as compensation for development. This issue contains articles written from each of these perspectives.

The articles highlight the benefits of strategic planning and prioritization of areas for restoration, the importance of community involvement, innovation and experimentation in weed control and restoration methods as well as sheer perseverance. Beyond the usual tales of hard work, blood, sweat and tears, these articles provide valuable ideas on how to undertake a successful restoration project from ways to engage the local community and stakeholders, to novel methods to employ.

The issue concludes with our regular features: Report from New Zealand Plant Conservation Network, Reports from Recent Workshops, Upcoming Conferences, Research Roundup; Book Reviews, Information Resources and Useful Websites.

Don't forget to register for the ANPC National Conference, to be held 29 October – 2 November in Canberra! The conference theme is *Plant Conservation in Australia: Achievements and Future Directions*. An apt theme for this, ANPC's 21st, year! For more information, to register or submit an abstract or proposals for workshops, go to http://www.anbg.gov.au/anpc/conferences/2012/index.html.

I hope you enjoy this issue on Bushland Restoration. It is overflowing with inspirational success stories and useful tips!

The south-east Queensland ecological restoration framework – the 'how to guide' for a biodiversity hotspot

*David Francis[1], Rhonda James[2] and Darren McPherson[3]**

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The region

Southeast Queensland (SEQ) is geographically broad and biologically diverse. In the southern portion of the bioregion are the local governments of Brisbane, Gold Coast, Logan, Redland, Ipswich, Moreton Bay, Sunshine Coast, Somerset, Scenic Rim, Lockyer Valley and Toowoomba. Combined, these local government areas within the SEQ bioregion occupy an area that is about one third the size of Tasmania.

The area has had a long history of settlement leading to the clearing of around 50 % of the region's remnant vegetation cover. Many of the fragmented patches have been the focus of restoration efforts by a diversity of groups ranging from dedicated volunteers, to committed teams in local government, through to industry fulfilling statutory requirements.

The problem

The quality of restoration effort has been inconsistent. There are indeed many examples of excellent ecological restoration work, but similarly some efforts have yielded poor results. The local governments of the region often include ecological restoration works as part of development approvals, conduct ecological restoration works on local conservation reserves and support individual landholders in ecological restoration efforts. These local authorities recognised the need for a 'how to guide' to direct ecological restoration efforts in the region.

Addressing the problem

At a meeting of environmental managers from local governments across SEQ, it was decided to initiate a process to achieve a level of consistency in the application and delivery of ecological restoration. SEQ Catchments, the regional Natural Resource Management body for SEQ, elected to facilitate the process in collaboration with the SEQ councils, with periodic input from other specialists from State government and industry.

The first step involved a scoping study of the stakeholders, which helped to establish the audience for communication purposes, and the broad application of a product of this nature, ranging from landholder guidance to development conditions. This helped to establish the composition of the Framework, and how information should be structured to make the product useful to all.

The other fundamental component was to clearly establish the principles of ecological restoration, and further to interpret that meaning in the SEQ landscape. The Society for Ecological Restoration International (SERI) definition, "Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed", provided the platform upon which a series of local policy, processes and management actions could be defined and explained in full.

The final agreed approach included the development of the "SEQ Ecological Framework" consisting of three key documents to guide the delivery of ecological restoration works in the SEQ region including:

- ***Code of Practice*** – a policy document providing a head of power for the subsequent Guidelines and Manual. The Code of practice reflects the SEQ policy environments where it is to be housed.
- ***Guidelines*** – a decision making tool to guide users to the most appropriate course of action in their project. This document guides application of the policy and links to current best practice and examples demonstrated in the Manual element.
- ***Manual*** – a technical but easy to use guide to all aspects of ecological restoration. This document is reflective of current best practice, and provides the minimum acceptable solutions to ecological restoration.

Developing the framework

The Framework drew not only on the experience of the authors, but also involved an extensive literature review, engagement of external parties (specifically for case studies) and, importantly, consultation with participating local governments. Consultation involved multiple reviews of the three documents and discussion at a series of workshops to reach consensus on all aspects of the Framework. Local government participants included officers involved with different aspects of ecological restoration including strategic planning, natural area management, coordination of community programs and development assessment. This enabled the integration of numerous perspectives and assisted in the development of a balanced document that reflected the requirements of multiple levels of government business and community activity.

'Fabricated' riparian ecological restoration in the Redland Business Park. Photo: David Francis

Although the approach allowed for thorough review and the input of multiple parties, it meant the final product took over two years to develop. This included some lively debate about many aspects of ecological restoration, with most participants contributing their own restoration experiences to the group. Despite these difficulties, it was this level of rigor that resulted in a document that pooled the collective knowledge of practitioners across a broad geographic area.

The final product

The final set of documents provides a range of stakeholders including council officers, professional bush regenerators, consultants and community members with the tools to ensure that best practice ecological restoration is implemented in a range of situations. The Code of Practice and the Guidelines provide decision makers with the policy and strategies to implement a restoration project. The Manual provides users with a practical hands on approach to all facets of ecological restoration.

The Manual guides the user through the four restoration approaches from:

- reliance on *Natural Regeneration*
- *Assisted Natural Regeneration*
- *Reconstruction*, where resilience is depleted, and abiotic or biotic elements need wholesale importation or major amendment before recovery can commence
- *Fabrication,* where site conditions have been irreversibly changed and it is not possible to restore the original native plant community.

*An ecological restoration team works to spray Asparagus Fern (*Asparagus aethiopicus*) as part of an 'Assisted Natural Regeneration' project. Photo: Rhonda James*

Site assessment is detailed as a step by step process which leads the reader back to which restoration approach, or combination of approaches to implement and the preparation of an Ecological Restoration Plan to guide the project. The next step provided in the Manual is starting work on the site and includes practical tips, photographs and diagrams. Details of manual, chemical, mechanical and biological weed control methods and various methods of re-introduction of plant material to a site including planting, brush matting and direct seeding are included. Case studies provide additional local information and guidance to the reader to undertake a restoration project. The final sections of the Manual include record keeping and monitoring and reporting.

Where to from here?

The SEQ Ecological Restoration Framework represents a major step forward in setting a benchmark for ecological restoration for the SEQ region. The Framework has received accreditation from the SEQ Council of Mayors as the regional standard for undertaking restoration, and following a midyear launch, will be available through all of the SEQ Council websites, or provided to key stakeholders as a hardcopy compilation. It is hoped that with ongoing use, and some further promotion, that the Framework will be broadly recognised and accepted as the best practice approach to ecological restoration in our region. There are opportunities to use the Framework to guide the establishment of environmental offsets in the region.

It is also hoped that our initiative can provide a template and guidance to land managers in other regions of the country. The document can be modified to local circumstances to ensure that best practice ecological restoration is successfully promoted and implemented. Importantly, our approach to developing the Framework demonstrates that expert collaboration is required to formulate the particular ecological restoration requirements for a specific bioregional area.

'Reconstructed' rainforest undertaken by the Brisbane Rainforest Action and Information Network (BRAIN). Photo David Francis

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The use of mitigation planting to achieve strategic planning outcomes in local riparian restoration

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Introduction

The Logan Water Alliance (LWA) is a public and private sector alliance involving Allconnex Water, Tenix, Parsons Brinckerhoff and Cardno. Established in August 2009, it is one of the largest water infrastructure programs of its type in Australia, responsible for delivering water and wastewater infrastructure throughout the Logan district (south-east Queensland) until at least 2013.

The LWA is a planning-led alliance that encourages consideration of ways to avoid, or mitigate, environmental impacts at a planning level, for example by choosing pipeline alignments that minimise vegetation clearing.

Significant effort is subsequently made during project design and construction to ensure the extent of impact is minimised and clearance of threatened species is avoided.

Nonetheless, the clearance of Least Concern native plant species protected under the *Nature Conservation Act 1992* is necessary to establish water and wastewater infrastructure. The clearance of native plants must comply with policy requirements of the Queensland Department of Environment and Heritage Protection (DEHP), including the provision of compensatory mitigation planting to achieve 'No Net Loss' of Least Concern plant species.

Strategic planning objectives

The Greenwood Lakes Reserve rehabilitation program was developed by the alliance in conjunction with Logan City Council's (LCC) Natural Areas Division and the DEHP, with the aim of identifying an existing reserve with the potential to function as a mitigation site whilst contributing to local environmental and social values. Strategically targeting a large-scale bushland restoration site (as opposed to the traditional piecemeal approach) allowed the alliance to progressively use the site across many projects over the course of the water infrastructure program. The 43 hectare reserve, located on the banks of Oxley Creek in Forestdale, Queensland, consists of two open riverine water bodies supporting 34 ha of fringing riparian vegetation suitable for restoration within Crown (Trust) Land zoned as Public Open Space.

The reserve forms part of the 60 km Flinders to Greenbank-Karawatha corridor which provides important habitat and movement opportunities for native fauna within south-east Queensland, linking larger tracts of remnant vegetation within the Greenbank Military Training Area to the south-west and the Glider Conservation Park to the north-east. The reserve was degraded due to past sand mining and clearing activities resulting in a modified vegetation structure and dense *Lantana camara* infestation that was significantly limiting habitat connectivity with adjacent remnant vegetation along the riparian corridor.

The reserve also contributes to the visual and social amenity of Forestdale as it is used by residents and visitors for passive recreational activities such as bird-watching, walking and lake-based activities. The rehabilitation program will provide a long term social and environmental asset for the local community.

Pre-restoration condition assessment

Prior to development of the rehabilitation program a comprehensive condition assessment was undertaken to classify vegetation into condition classes, collect empirical data relating to the extent of weed invasion and provide a formal methodology for assessment of vegetation condition for future reserves. The condition assessment used a belt-transect method to assess the condition of vegetation within 20 x 20 m quadrats that were allocated a score relative to the integrity of each vegetation stratum and abundance of weed species. These were then ranked through comparison to a reference community. The results of the vegetation condition assessment were mapped and used to prioritise bushland restoration areas and define management actions across the reserve.

The 'long-shot' sling shot being used to collect seed from within the site to ensure that the local genetic variation was incorporated into planting. Photo: Murray Swales.

Nursery used to propagate the seed collected from the reserve, 10,000 tubes were 'grown-on' from the seed collection, including 24 species of trees and shrubs. Photo: LWA.

Riparian restoration methodology

The aim of the rehabilitation program is to improve the quality of habitat and ecosystem functioning of the reserve while stabilising the soils from future erosion. An overarching restoration guideline was developed, namely the Terrestrial Vegetation Management Plan (the Plan), utilising the results of the vegetation condition assessment and relevant LCC and DEHP conditions. The duration of the Plan includes a maintenance phase of three years (inclusive of a six month establishment period) which was defined by the DEHP conditions.

The Plan defines the vegetation management objectives for the rehabilitation program and outlines associated management actions, including:

- a staged program of weed control
- assisted regeneration practices within areas of the reserve identified as supporting sufficient representation of native species
- targeted revegetation for open areas identified as supporting an insufficient representation of native species or exhibiting missing or underrepresented vegetation stratum components
- a detailed monitoring program to check that performance indicators for revegetation, rehabilitation and weed control are achieved
- an adaptive management strategy, including an event contingency plan, to cover issues that can arise from natural disasters, allowing for a 'natural response' period prior to performing any further active revegetation following an event.

Erosion controls were identified as a key consideration in degraded areas and where high level weed controls were likely to result in soil disturbance and exposed areas. In order to determine where soil amelioration was required, the underlying soils of the reserve were analysed. The assessment identified a high level of dispersive clays (also evident as gully erosion and sinkholes from past sand mining) and low pH (pH range of 4.2 - 6.2, mean pH of 5.2). Ameliorant regimes were developed and added to the individual infill tubestock, with the goal of improving the general soil structure over a five year period (i.e. increasing pH and improving the clay properties in the upper soil strata), hence improving not only growing conditions but minimising future erosion issues.

LWA staff and contractors participating in the revegetation works after the site's initial pest plant treatment. Photo: LWA.

In order to facilitate the natural formation of a healthy vegetation community representative of the original landscape, the planting schedule for the mitigation planting was derived from the pre-existing Regional Ecosystem descriptions provided by DEHP mapping and field observations. Seed was collected from the site to ensure that the local genetic variation was incorporated into the planting. Four months prior to the works, the seeds from 24 species were collected within the reserve, comprising nine tree species and 15 small trees / shrubs, for propagation and revegetation activities.

Outcomes

The initial phase of the rehabilitation program commenced in August 2011, targeting vegetation mapped in poor to moderate condition and included the following key activities:

- restoration of 12 ha of riparian forest within the reserve, inclusive of a three hectare area of high level weed infestation (3-4 m high *Lantana camara*);
- active revegetation totalling 81,516 plantings, including 10,000 tubes propagated from 'in situ' seed collection; and
- installation of 34 nest boxes to provide compensatory nesting and denning habitat for a range of endemic species.

The preliminary results of quadrat monitoring (at five permanent and ten random plots), undertaken at the completion of the initial phase of restoration activities in February 2012, indicate that the Plan requirements with respect to weed control targets (<20% non-natives after establishment period) and vegetation benchmarks for active revegetation (>90% survival of infill plantings) have been met. Natural regeneration is still in the early stages and would not be expected to meet relevant performance indicators at this point.

Overall, the Greenwood Lakes Reserve rehabilitation program has been successful in achieving strategic planning outcomes for the Logan district by benefiting broader environmental and social values. Similar strategic mitigation planting models could be used effectively on large scale infrastructure projects to deliver sustainable long-term restoration outcomes that improve the quality of habitat and ecosystem functioning by reconnecting fragmented corridors.

Acknowledgements

We would like to thank and acknowledge the LWA Environment Team, including former members, for their contributions during LWA's rehabilitation program and the LCC Natural Areas Division and DEHP for their preliminary direction and defined objectives.

Tweed-Byron Bush Futures Project: improving urban and peri-urban bushland sustainability in Tweed and Byron Shires

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The Tweed-Byron Bush Futures Project was developed as a joint project between Tweed and Byron Shire Councils to address a common need for improved bushland management in urban and peri-urban areas. Funding for the project was gained from the NSW Government's Environmental Trust Urban Sustainability Program. The project has been highly successful winning the 2011 NSW State Landcare Award for Local Government Landcare Partnership and overall category winner in the Natural Environment Protection and Enhancement: On-ground Works Award at the 2010/11 Local Government and Shires Association (LGSA) Local Government Excellence in the Environment Awards.

The main aims of the project are to:

- undertake extensive on-ground work to restore native urban and peri-urban bushland and minimise threats;
- engage with residents to raise awareness of the values and threats to urban bushland; and
- reinforce council's role in managing bushland reserves.

A holistic approach to achieving improved bushland management has been incorporated in the project through establishment of a working steering committee (comprising Council staff, Landcare representatives, NSW Environmental Trust and Northern Rivers Catchment Management Authority staff); identifying and communicating with a range of stakeholders; development of a business plan which includes a communication strategy; and undertaking an extensive audit of urban bushland to guide project implementation. The project involves innovative partnerships with Landcare and Dunecare volunteers, local indigenous groups and environmental training and employment providers to improve management of urban bushland.

Bushland audit

A targeted and comprehensive audit (Bushland Restoration Services *et al.* 2010) was undertaken across 985 ha of public and adjoining urban bushland to determine values, threats, and management issues at selected sites. To facilitate the audit a rapid assessment methodology was devised to determine bushland health based on five variables (vegetation structure and composition, weeds severity and density, connectivity, habitat features, and other threats). The data was used to classify and map rehabilitation requirements at surveyed sites and to prioritise sites for on-ground works.

The audit found that the areas in best condition were larger remnants and those at some distance from urban areas or where adjacent development was relatively recent. Exceptions were remnants where restoration works had already been undertaken.

Weeds were the most commonly recorded threat being recorded at all sites. Introduced grasses were the most common weed and five of the top 20 weeds recorded were rated as major weeds due to their capacity to persist and spread and difficulty of control. These included Asparagus Fern (*Asparagus* spp.), Madeira Vine (*Anredera cordifolia*), Morning Glory (*Ipomoea* spp.), Cat's Claw Creeper (*Macfadyena unguis-cati)* and Privets (*Ligustrum* spp.).

Other threats included dumping of rubbish and green waste and incursions by neighbours.

The audit also provided indicative cost estimates for 10 Management Intensity Classes of restoration which detail the frequency of works required to restore a site to a 'maintenance' level and how many years this would take to achieve.

Table 1. Summary of the results of the bushland health assessment

Bushland Health Class	Area (ha)	Area (%)	Number of sites	Percentage of sites	Average size (ha)
A - Good	505.36	51.3%	36	18.7%	14
B - Moderate	314.76	32%	79	40.9%	4.0
C - Poor	73.14	7.4%	40	20.7%	1.8
D - Very Poor	91.8	9.3%	38	19.7%	2.4
Total	985.07	100%	193	100%	5.1

On-ground restoration

On ground restoration works commenced in June 2010 and have involved extensive primary and follow up weed control at 70 sites and follow up maintenance at five sites, with all works completed in May 2012. While final collation of reports has not been completed it is evident that works covering 125 ha have resulted in significant reductions in weed density and severity, removal of rubbish, nest box installation, feral animal control and interpretive sign installation. The project has involved management planning and restoration of more than 10 vegetation communities including seven endangered ecological communities, areas protected by State Environmental Planning Policy (SEPP) 26 Littoral Rainforest and SEPP 14 Coastal Wetlands, and habitat for threatened flora and fauna species.

Site Action Plans were prepared or updated for each site prior to the commencement of work using a template developed for the project. All plans incorporated the rapid assessment methodology developed for the audit as a monitoring and evaluation proforma that was completed before, during and after works to facilitate assessment of the success of works programs.

Sugar Gliders using a nest box installed during the project at Byron Bay cemetery. Photo: Angus Underwood

Community native garden planting Federal Community Children's Centre. Photo: John Leedom

The majority of restoration works centered on weed control to assist recruitment of native species. Many of the weeds controlled have spread from adjacent properties e.g. Arrowhead Vine (*Syngonium podophyllum*) and Singapore Daisy (*Sphagneticola trilobata*). To address this and other neighbour/bushland interface issues extensive communication was conducted with all neighbours of worked sites through supply of over 1200 letters containing flyers outlining the project's aims, copies of *Bushland Friendly Nursery Scheme* brochures and relevant fact sheets including *Creating a Bushland Friendly Backyard*.

Considerable and persistent rainfall coincided with the on ground phase of the project and restricted the planned and timely roll out of works, which were often undertaken opportunistically.

Project outcomes

Project outcomes to date include:

- Over 17,000 hours of professional on-ground bushland restoration;
- 30 nest boxes installed and monitored, 16 of these are being used by arboreal mammals (22 Sugar Gliders and seven Long-eared Bats were recorded in June 2011) while some boxes have been invaded by ants;
- Over 50 community engagement activities held including field days at work sites, workshops on urban gardening and wildlife, talks at schools and garden clubs, planting of bushland friendly gardens and weed and feral animal ID;
- 60 National Green Jobs Corps trainees supported to undertake work at Landcare sites and complete their TAFE Certificate II in Conservation & Land Management;
- Support for the training and mentoring of four indigenous bush regenerators engaged by contractors Madhima Gulgan Community Association;
- Preparation of a Care Group Procedures Manual to guide the establishment of and ongoing support for Landcare and Dunecare groups;
- Innovative work in the Byron Dwarf Graminoid Clay Heath Endangered Ecological Community;
- Development of fact sheets including: *Nest Boxes for Wildlif*e, *Urban Rabbit Control*, and *Guidelines for bush regenerators working in Flying Fox camps*;
- Compilation of a *Native Species Planting Guide* to inform species selection for landscape scale restoration to suburban backyard planting;
- Production of a *Butterflies of north-east NSW and south-east Queensland* poster for distribution to the community;
- Workshops for executive management and Councillors outlining Council's Natural Resource Management (NRM) responsibilities and delivery of NRM surveys to all Council staff;

- Completion of seven 'Sustainable Streets' programs which engaged an average of 10 households and 40 participants in reducing energy and water use and a range of sustainable activity workshops;
- Formation of 'Toad Buster' groups and running of regular 'Musters' with over 5,000 toads collected to date; and
- 25 community based Indian Myna trappers have caught over 6000 birds across both Shires.

Extensive media has been generated over the life of the project which has helped promote not only the works being undertaken but the idea that healthy bushland is important to fauna and flora as well as its neighbours and that its future commences in everybody's back garden.

References

Bushland Restoration Services, EnviTE, Landmark Ecological Services Pty. Ltd. and AS Murray & Associates, 2010, Tweed Byron Bushland Audit, unpublished report to Tweed Shire Council, November 2010.

Community planting adjacent Stotts Island Nature Reserve with Coolangatta Tweed Heads Lions Club members, National Green Jobs Corp team, contractors and Tweed Shire Council staff. Photo: John Turnbull

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High impact bush regeneration: is there a role for heavy machinery?

Lee Andresen

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Background

Victorian Coastal Tea Tree (*Leptospermum laevigatum)* has had damaging consequences for dunal ecosystems of the NSW Far North Coast, equaling those of Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotundata*). Forty years since the species' introduction, substantial forests of durable bushfire prone hardwood have developed. Large populations of juveniles have spread, posing additional challenges to other areas under regeneration.

By 1989, when dune restoration began at Angels Beach in East Ballina, *L. laevigatum* had already colonised hectare sized patches forming impenetrable monocultures. Originally planted to stabilise high dunes, when works installations were abandoned after heavy mineral sand mining in the 1960s, they have seriously obstructed Littoral Rainforest recovery 50 years on.

The problem

Senescent Coastal Tea Tree, often 10 m high with trunks 25 cm wide, were found collapsing leeward, while younger fruiting trees invaded distant areas, raining seed downwind. Conventional strategies had little to say about rectifying such a problem.

The Coastal Tea Tree's legendary hardness made chainsawing unlikely. If sawn, the logs were too heavy for volunteers to shift. And even then, abandoned logs remained undegraded for years. Layered piles of collapsed trunks inhibited natural regeneration by shading the sand. The high oil content contributed to the wood's resilience but possibly also suppressed local species germination.

Within this milieu the only surviving natives comprised *Banksia integrifolia, Persoonia stradbrokensis, Acacia longifolia* subsp. *sophorae* and *Monotoca scoparia*. A few vines (*Hibbertia scandens, Stephania japonica, Pandorea pandorana)* climbed the dead Coastal Tea Trees.

The first-line challenges were to safely remove and dispose of the virtually indestructible timber, and to establish forest regrowth in an evidently hostile soil.

Legislative and technical barriers

Since Coastal Tea Tree is an Australian native species, the NSW *Native Vegetation Act 2003* made its removal illegal. The Catchment Management Authority could not approve grant funding for a removal project.

Moves were, however, already in play to have the species declared feral. The green light came in January 2009 when Coastal Tea Tree on the NSW Far North Coast was listed by Ministerial Regulation as a 'feral native species' within the Coastal Zone and on or adjoining land previously sand-mined for heavy metals.

With funding now legal, what would it be used for? How could these seemingly immovable trunks be shifted without disruption to the dunes and without damaging the recovering native vegetation that bordered, and in places merged, into the affected areas?

Coastal Tea Tree had however been successfully removed on the Tweed and Evans Head coasts, mainly for bushfire protection, using a heavy duty machine - the imported German C100 Rayco track mulcher.

A local company quoted their price for mulching, approximately 1 hectare over 2 days. With approvals in hand, a successful Caring for our Country 'Community Coastcare' grant application for $8,390 was lodged. The primary job was completed over two days in April 2010.

(top to bottom) Eco-mulching operation (April 2010). Compensatory replanting (June 2010). Photos: Lee Andresen.

Project stages

The project was undertaken over ten stages:

1. Hand removing a suite of ground level weeds that might otherwise be buried or mulched up and spread during the operation – Asparagus Fern (*Asparagus aethiopicus*), Morning Glory (*Ipomoea cairica*), Passionfruit (*Passiflora* spp.), Lantana (*Lantana camara*), and Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotundata*).
2. Protecting existing natural recovery by flagging all native trees, bushes and groundcovers within and on the margins of the Coastal Tea Tree using fluoro tape. *Callitris columellaris* had principal priority protection.
3. Mapping the area of an Endangered Ecological Community (Coast Cypress Forest), to locate boundaries for the area to be mulched then staking these out using white posts to guide the machinery operator.
4. Rostering and equipping volunteers with hard hats and walkie talkies and briefing them on how to assist the machinery operator. OH&S considerations were paramount since the mulcher throws lethally heavy pieces of hardwood debris randomly up to 50 m.
5. Enlisting an Indigenous heritage site supervisor, given that the entire beach is a sacred Indigenous site of traditional significance and closely associated with a 19th Century massacre.
6. Guiding the machinery operator, avoiding flagged native trees, pausing the operation whenever possible damage to standing native plants loomed then negotiating which trees were of least value and could be sacrificed to achieve best economic outcomes while minimising ecological loss.
7. Intensive follow up during the following weeks. Some upright unmulched Coastal Tea Trees remained in close proximity to significant native species so were then either removed with a chainsaw or ring barked to stand as bird perches.
8. The area was left two months to settle until June 2010 when we enlisted local school students to start replanting selected rainforest species. Ten seedlings were planted to compensate for each of about ten significant individuals cleared, the smaller of which were buried under debris and the remainder had branches damaged. *Cupaniopsis anacardioides* (Tuckeroo) tubestock, grown from local seeds, was the choice to provide a head start to the structure for a future Tuckeroo-association Littoral Rainforest.
9. After one year of significant natural recovery, on National Tree Day July 2011, the area was included with a neighbouring site for selected diversification with locally sourced, site specific rainforest species.
10. Over the second year (to June 2012) the site continued natural recovery with no further investment other than hand removing emergent weeds – Asparagus Fern, annual herbs and grasses.

The outcome

Heavy machine mulching produced variable sized fragments ranging from dust and woodchip up to slabs and splinters 0.5 m long. A thick layer of wood fragments remained on the sand, and roots remained buried. This unusual soil surface will persist for years but we have learned to work with it.

This method provided some excellent results for native diversity:

- Today, 27 months after mulching, a very high survival rate of all replacement rainforest trees;
- Impressive growth rate for the original naturally surviving trees (those 'saved' by tagging) that are now prospering within and on the boundaries of the cleared site;
- A spectacular abundance of fast growing pioneer species, spontaneously recruited from surrounding old growth and regrowth forest areas. A low canopy now partly shades out the mulched avenue that was once an exposed desert of woodchips and hardwood fragments. Naturally regenerating species (excluding replacement plantings) include:

  Acacia melanoxylon
  Acacia longifolia subsp. *sophorae*
  Acacia suaveolens
  Acacia ulicifolia
  Acronychia imperforata
  Banksia integrifolia
  Breynia oblongifolia
  Callitris columellaris
  Commelina cyanea
  Commersonia bartramia
  Cupaniopsis anacardioides
  Cymbopogon refractus
  Cyperus eglobosus
  Dianella caerulea
  Duboisia myoporoides
  Geitonoplesium cymosum
  Glochidion sumatranum
  Glycine clandestina
  Hibbertia scandens
  Imperata cylindrica
  Isolepis nodosa
  Macaranga tanarius
  Mallotus discolor
  Monotoca elliptica
  Nematolepis squamea
  Notelaea longifolia f. glabra
  Pandorea pandorana
  Persoonia stradbrokensis
  Pomax umbellata
  Smilax australis
  Stephania japonica
  Zieria laevigata.

(top to bottom) Collapsed senescent Leptospermum laevigatum *(April 2010).Natural recovery of rainforest pioneers, groundcovers and heath species (May 2012). Photos: Lee Andresen.*

What once was a feral forest now merges with surrounding restored areas forming a continuous green recovery zone. It is not yet a recognisable Littoral Rainforest, but one will eventually develop successionally from the present community of pioneers and transitional heath.

Conclusion

Removing senescent Coastal Tea Tree forest initially presented a challenge when examined from the perspective of conventional bushland recovery strategies. That has been handled through a well-planned, carefully executed project beginning with the targeted, high impact employment of heavy machinery followed by a combination of replacement planting and natural regeneration.

The strategy emerged only after study, consultation, small scale experimentation and local debate. There were early fears and objections but despite forebodings the project delivered what we wanted.

When faced with a really hard problem rehabilitation teams may sometimes need to grasp the opportunity and embrace a relatively 'heroic' and untested measure. We did, and it has worked. We hope our experience may be a model for others facing a similar challenge.

A forty year history of bushcare at Bonnet Bay, NSW

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Background

Bonnet Bay is an island suburb of some 600 houses in Sydney's Sutherland Shire Local Government Area, contained within a ring of bushland reserves and the Woronora River. The subdivision was constructed in the 1970s and the ring of bush was in natural but somewhat degraded condition thanks to the usual Sydney weeds –Privet (*Ligustrum* spp), Lantana (*Lantana camara*), blackberry (*Rubus* spp.), Cassia (*Senna pendula*), Ochna (*Ochna serrulata*), Honeysuckle (*Lonicera japonica*), Asparagus Fern (*Asparagus aethiopicus*) and Trad (*Tradescantia fluminensis*). There was no history of agriculture or industry in the area apart from oyster farming in the tidal areas of the Woronora River. While this 60 ha of bushland is contiguous it is divided into 2 "reserves" (The Glen and Koolangarra reserves) and one "sanctuary" ("Burnum Burnum" named after a local indigenous elder). The whole is designated as "fire prone" due to topography and proximity to housing. In the 1994 fires some 100 homes were lost in the adjoining suburb, Como. The terrain is Sydney sandstone with steep gullies, creeks, escarpments and with one sandstone plateau. It is virtually unique in the Sydney catchment in being an undeveloped estuarine environment.

Early activities

In the 1970s local Councils had responsibility for rubbish disposal and the common practice was to use a bushland gully as a tip until it was full then to seal it with a layer of clean fill, install drainage and grass and make the now level area available for "community purposes". This was the plan for much of the bushland around Bonnet Bay so local residents petitioned Council to have the bush left as passive recreation reserve(s). It was a happy coincidence that the NSW State Government decided at this time to protect urban bushland and so Council agreed with the petition which offered Council a low cost option thanks to volunteer labour to maintain the reserves. An important part of this agreement was that the area(s) be available to the public through the construction of walking tracks. This was and remains a key strategic concept – that the bush be available to people and not simply be kept as some exclusive nature park. Early attempts at weed control were very amateurish – the group used machetes as their primary tool and simply went about whacking weeds.

Formal Bushcare

In the 1990s Council began to support volunteers with professional resources. Volunteers were given training and supplied with equipment and herbicides. This phase was interesting as the tools then used were 24 inch bow saws and 1 L bottles of glyphosate. This indicates the physical task – the usual woody weeds were fully grown, Lantana formed dense monoculture thickets, Honeysuckle infested the swampy parts and it was all primary weeding needing heavy tools and litres of glyphosate. Now most work is done with secateurs and drip-bottles for herbicide.

Community

One feature of the early years (1980-90s) was the ability to communicate with the suburb through a monthly circular provided by a local real estate agent. This agency wanted to promote itself with the community and published a monthly newsletter with invited articles from community groups. We, in Bushcare, were able to use this newsletter, which was distributed to every letterbox, to explain our objectives, strategies and activities. The newsletter did not result in anyone actually joining the Bushcare volunteers but it did give people a good understanding of what we were doing and how it might benefit them. A typical theme in the articles was "Good quality bushland adds to the

Saved! The bushland gully was earmarked for use as a tip to be capped with clean fill and grassed for "community purposes". Photo: Huw Morgan value of your property …". The net result, I believe, was that Bushcare was regarded much like the Salvos – that no one ever goes to their meetings but everyone agrees that they do a good job. This exercise in PR was strategic as there are many worthy demands on Council for open space, whether for a scout hall, netball or tennis courts, playing fields, training space for horses or dogs, and so on. Without strong community acceptance "unused" bushland will be allocated to other purposes.

For 10 years we have been involved with the local school in organised bush walks and other educational activities. There is a well publicised day each year in Spring with guided tours of the bushland. This is again a deliberate strategy to connect with the community.

The golden years

A major consideration for weeding is disposal, including disposal while working. Any tree, such as Privet or Camphor, takes up much more space lying down than it does standing up and it is not unusual for most of the available effort of volunteers to be taken by removing material from the worksite. We were lucky in that, for 15 golden years, Council would roster (on request) field staff who were also with the Rural Fire Service (RFS). This meant, when conditions were suitable, that weed materials could be burnt on the spot without having to bag them or carry them for roadside collection. Unfortunately this arrangement came to an end when Council relinquished all "burning" to the RFS proper who promised to continue to support Bushcare – as resources and circumstances allowed. This unfortunately meant the end of pile burns due to lack of available resources.

Planting

The group(s) generally take the view that planting (regeneration) in a fire prone area is a poor tactic. It can upset neighbours if strangers start planting outside their back fence, it requires considerable resources to water new plants, new plantings may be slashed for hazard control, and fire as well as control burns can undo a lot of work. Our tactic is to manage the weeds and to let god do the planting.

Outcomes

The original simple circuit track has been extended to provide a network of (ungraded) tracks which includes a short boardwalk into a Swamp Oak (*Casuarina glauca*) and Paperbark (*Melaleuca* spp.) enclave. All up there would be 10 km of walking track. The historical weeds – Privet, Lantana, Blackberry, Camphor, Honeysuckle – were relatively easy to defeat given enough time, however, weeds which do not respond as desired to glyphosate remain a problem, particularly Trad, Asparagus Fern and Ochna. New threats such as Asthma Weed (*Parietaria judaica*) and Corky passionflower (*Passiflora suberosa*) arrive to colonise areas which have been restored.

Lessons learnt- the strategies that worked

More than forty years of Bushcare in the area have shown the following strategies to be critical to success:

- The first strategy is to get the responsible authority for the land on-side, and to keep them there. In this case it was Sutherland Council and the critical point was that the proposal for a passive bushland reserve appeared to Council as a low cost option when compared to playing fields, tennis courts, etc. One keeps them on-side by honouring commitments and by putting in the hours of volunteer work in the bush. It was critical that the proposal came from a group, not an individual.
- It is critical to have community support. This requires compromises such as welcoming the use of tracks by dog owners even though not all are track-trained. Involvement with a school community is another means to build a good reputation.
- Adapt your methods to suit the local conditions and the support given. For example, if assistance for a program ceases, such as on the spot pile burns, just accept it and manage without. Planting may be necessary in truly degraded areas but in fire prone areas one is simply planting risk.

The provision of walking tracks was and remains a key strategic concept – that the bush be available for people to enjoy. Engagement of the local community has also involved regular newsletters, organised bush walks and other educational activities. Photo: Huw Morgan

Hawthorn eradication - an Aranda Bushland story

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Sometimes diligent weed control is all that's needed to take a Hawthorn (*Crataegus monogyna*) and Briar (*Rosa rubiginosa*) thicket back to diverse Box Gum Woodland. This story celebrates twenty years of dedicated parkcare focused on weed control without recourse to planting. It tells how Friends of Aranda Bushland demolished a 300 x 100 m Hawthorn thicket in 1992, continued intensive action for three years, then three yearly Hawthorn hunts, blitzes of subsequent weeds and a project to tackle Hawthorns in the adjoining rural lease slowly to ensure natural regeneration of wildlife habitat.

Hawthorn patch project

Friends of Aranda Bushland started in September 1990 when cattle appeared in the eucalypt forest behind homes in Aranda, a Canberra suburb next to Black Mountain Reserve. Apparently, the Bindubi Street wooded slopes were rural lease rather than Aranda Bushland Reserve. Parkcare was then a new Landcare initiative in the ACT and well supported by Parks & Conservation Service. Our inaugural convenor, Merilyn Evans set high conservation and rehabilitation aims so we followed the Bradley philosophy of working from the best and weeding rather than planting. We started by removing Cotoneaster (*Cotoneaster glaucophyllus*), Pyracantha (*Pyracantha* sp.) and Pampas Grass (*Cortaderia* sp.) to give natural regeneration a chance.

By January 1992, our lobbying had helped double the size of the reserve taking in all of the wooded slopes. However, the new part was much weedier with great tangles of Hawthorn (*Crataegus monogyna*) and Briar Rose (*Rosa rubiginosa*) on the lowest slopes. These were the plants of the early settlers. Our first foray into the new site was April that year in the triangle east of the Hawthorn thicket - the least weedy patch. There are great pictures of Briar tangles, the head ranger, Tony Brownlie with his trusty chainsaw and his Anzac Day workparty. The Gang Gangs were so drunk on Hawthorn berries that they would not move and it felt cruel to be removing their tucker.

No one believed we would conquer the 300 m^2 Hawthorn thicket, but Pam and Colin Macdonald led the first attacks in November when it was in full flower. It was all cut and dab with pink poison (government issue Roundup/Zero with beetroot colour). Colin produced the crosscut saw for the big ones when there were no chain sawing rangers available. Perhaps we were not true Bradley. However, we continued enthusiastic work parties until we had demolished all hawthorn and briar rose infestations within eight months.

It was great fun and I still rate challenging Hawthorns above planting trees. Our large working parties exposed magnificent Apple Box (*Eucalyptus bridgesiana*) and Candlebark (*E. rubida)* on the flat with Broad-leaved Peppermint (*E. dives*) at the forest edge. Brightly flowering *Hibbertia* spp. still flourish as does the *Microlaena* grass.

In hindsight, I can see that this success bred confidence. Once our patch was 90% free of woody weeds, we realised how special it was and embarked on an ambitious project to document its diverse flora, map the area, create herbarium specimens and publish a field guide. We lobbied to protect our bushland against high impact recreation, obtained heritage listing for Aranda Snow Gums and National Heritage Trust (NHT) funded signage for our self-guided *Frost Hollow to Forest Walk*.

There were downsides in demolishing so much at once. We lost bird cover and created a fire hazard as debris was not removed quickly. We missed some woody weeds and they reshooted and more came up. We faced issues of subsequent weeds, long term seedbanks and neighbouring infestation and thus decided to move slowly to allow for habitat recovery.

Diligent weed control

Followup from 1993 to 1996 included tackling Honeysuckle, Thistles, White Violets, Sticky Weed (Crowsfoot), an experimental burn (that didn't help), utilising conservation volunteer and 'naughty boy' teams as well as many parkcare work parties targeting seedling Hawthorns and reshooting Briar. One can never catch the Briar on the first go. The debris was removed at last in a joint work party with parkcare, rangers and community workers in June 1996. After that the old Hawthorn patch was looking good – dedicated individuals and work parties kept it so. My photos show the value of intensive follow up for the first three years then Hawthorn/Briar hunts every three years. Our May 2012 work party took out scattered knee high Hawthorns and Thistles.

(left) This is indeed a woody weed – second attack on thicket 14 Nov 1992. (right) Seven years later – eucalypt regeneration, Pam Macdonald, Bill Packard and our field guide. Photos: Jean Geue

An unexpected subsequent weed cropped up when Phalaris (*Phalaris aquatica*) (that had just been along the creek) flourished after the old Hawthorn patch was waterlogged in the wet winter of August 1998. We discouraged Phalaris with 'bringing in the hay' work parties in August 2005 and May 2006. The drought helped, but Phalaris flourished again when the rains came in 2010-12.

Rural lease work parties

Tackling sources of weeds on the adjoining Glenloch rural lease started with a Weedbusters Week event in October 1998 as the six years since the initial project had allowed habitat regeneration. During our negotiations in 2000 for a public corridor through the rural lease for our interpretative walk, we committed to an annual well-advertised parkcare work party. Our June 2012 work party should see the end of the chainsaw size hawthorns. We continue to watch and hunt subsequent weeds and trust, one day, the adjoining rural lease paddocks with their high conservation value Box-Gum Woodland will be taken into reserve.

Control techniques

Friends of Aranda Bushland's weed control techniques have concentrated on cut and dab with big loppers and handsaws. We prefer to dig and remove the bulk first. Contract spraying of Hawthorns and Briar in the early days was not effective as we had to come back later. We advertise digging without poison so kids and their parents can contribute. Occasionally, chainsawing rangers are able to help. Our Hawthorn hunt work parties call 'to seek and destroy knee high Hawthorns'. Thistles continue to rear their nasty heads but are easy to chop out or poison when small. Unfortunately, it is much harder to sell follow up weeding than to sell planting parties. Weeding results can be amazing, but they take time and long term commitment.

In the early years we used Roundup/Zero in spray bottles but adopted the more precise Zero wands with great enthusiasm in the early 2000s. By 2010, we had access to parkcare ChemCert training for broadleaf spraying of Brushoff and Starane which made us more effective. We can often respond in a more timely fashion than government contractors. In the same year, Colin (who is no longer fit enough to use a crosscut saw) used his digital camera, GPS, Google maps and email to alert younger parkcarers to hit isolated Hawthorns and other woody weeds.

What we learnt

What we learnt was that diverse natural regeneration is possible without planting if remnant bushland is nearby and a native seedbank still exists. Removing challenging Hawthorns is fun but, if done too quickly, reduces habitat. Debris provides habitat, leaky weirs and protection of regeneration from grazing – pity we did not know that earlier. Persistent long term follow up is critical and the weed seedbank must be managed. Parkcare convenors need a break to avoid burnout. Delicious morning teas build teams and it's great to be out in the bush.

Parkcarers can make a difference.

Find out more

www.FriendsOfArandaBushland.org.au

Friends of the Aranda Bushland (2007). *Our Patch; field guide to the flora of the Australian Capital Region*. 2nd ed. Friends of Aranda Bushland, Canberra.

Burn piles and planting at Latrobeana Terrace – Restoration of a grassy forest community in Eltham South, Victoria

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Introduction

Beginning in 2005, Cam Beardsell of Parks Victoria began a restoration program within an area of grassy forest of high ecological significance in Eltham South, situated approximately 25 km north-east of Melbourne. The site is locally known as Latrobeana Terrace, in recognition of a large population of Clover Glycine (*Glycine latrobeana*) occurring within the site.

Latrobeana Terrace consists of an area of 1 ha (100 m x 100 m) within the Morrisons Nature Conservation Reserve (NCR). The vegetation of the site is dominated by Yellow Box (*Eucalyptus melliodora*) and Candlebark (*Eucalyptus rubida*) and is attributable to the Ecological Vegetation Class (EVC) Valley Grassy Forest. This EVC is listed as vulnerable within the Highlands Southern Fall bioregion.

Latrobeana Terrace and the surrounding reserve were formerly in private ownership and utilised for low density cattle grazing until the mid 1990s. Most canopy trees within the site were cleared sometime in the mid twentieth century, with the current canopy comprising regrowth from around this time.

Botanists who passed through the site in the 1990s remember it being covered by dense shrubland of Yarra Burgan (*Kunzea leptospermoides*) and Hedge Wattle (*Acacia paradoxa*) (pers. comm., Damien Cook, Australian Ecosystems), two disturbance promoted indigenous shrubs. It appears that clearance of the eucalypt canopy and disturbance by rabbits had led to thick regeneration of these species that was out of balance with more typical regeneration, leading to suppression of ground flora.

Following a floristic survey of Morrisons NCR in 1994/95, Cam Beardsell identified the future restoration site as of high ecological significance. Despite the thick stands of Yarra Burgan and Hedge Wattle, over 215 indigenous flora taxa were recorded over time, including nine Victorian threatened species, two nationally threatened species and over 60 species that are regionally rare or threatened. It was clearly evident that the site needed urgent protection and management to maintain its very high ecological values.

In 1996 a small fence was placed around approximately 20 plants of Clover Glycine to protect them from rabbit grazing, which led to recruitment and increase in population size.

Threatening processes

More detailed work began at the site in 2005. Regular visits identified a range of threatening processes in addition to the shrub invasion. Grazing pressure by rabbits, Black Wallaby and Eastern Grey Kangaroo were impacting many plant species, particularly the more palatable herbs and shrubs. This had reduced some threatened flora to very small population numbers. Several exotic grasses had become locally abundant, particularly Sweet Vernal Grass (*Anthoxanthum odoratum*), Large Quaking Grass (*Briza maxima*) and Panic Veldt-grass (*Ehrharta erecta*).

Project aims

The principle aims of the project were to:

- restrict grazing pressure by native and feral herbivores;
- reduce the cover of Yarra Burgan to minimise competition with less robust plant species;
- increase population densities of less common flora, particularly threatened taxa;
- control exotic plant species.

Methods

Fencing

The first step was to halt excessive grazing pressure by rabbits and macropods. This was achieved by erecting a 1.5 m high ringlock fence around the entire site. The fence included a buried skirting to prevent rabbits from digging into the site, and two top strands of wire to prevent macropods from jumping or climbing in.

Challenges: Although the fence has been highly effective, it has taken a lot of maintenance and fine-tuning to keep out herbivores. Tree branches have occasionally fallen on to the fence, allowing kangaroos access, while at one point the lower skirting became damaged, allowing rabbits to get in.

Shrub thinning

The thick stands of Yarra Burgan and Hedge Wattle were thinned across the site to less than 10% cover. This was thought to be a more appropriate density that removed excessive competition for water, light and nutrients while still leaving some refuge for small birds. The shrubs were removed with a hand saw and the stump painted with a small amount of herbicide to prevent reshooting. The cut branches were then placed in scattered piles throughout the site and burned during autumn. These burn piles created nutrient rich sites ideal for planting.

Planting

The burn sites were planted with a range of uncommon to rare indigenous species, all of which had been grown from propagules collected within the site. Species selected for planting were predominantly herbs and small shrubs, although some rare grasses were included. Most of the planting was undertaken using a digging crowbar, as the narrow head on this tool provided the least disturbance to the soil profile. Eventually over 20 burn sites were planted. Because of slight variations in topographic relief and soil properties, species had to be carefully selected for the appropriate location. This required a detailed knowledge of the requirements of each species, which was fine-tuned with trial and error. Micro-features within the site such as old stump holes, spring soaks and bare patches were occasionally utilised and planted with appropriate species.

Challenges: The plantings required a lot of work over several years. All planting was undertaken during a long-term drought, and significant work had to be invested in constant hand watering to help plants establish. Despite the high level of care, many mortalities occurred in the first few years. Plantings were also occasionally grazed by macropods that had found their way into the fenced area.

Weed control

Grassy and herbaceous weeds were removed by hand or occasionally using herbicide or a weed burner. Most control was undertaken during the winter months prior to seeding.

Challenges: After several year of control, most grassy and herbaceous weeds were reduced to very low levels. But following drought-breaking rains in 2010-11, many annual weeds have germinated in large numbers, creating significant challenges. However, it is likely that weed invasion would have been far greater if recovery of native grass cover had not been increased through fencing and grazing exclusion.

Results

After more than six years of intensive work, the restoration site has improved significantly in quality. It now contains some of the largest populations in the region of a range of regionally to nationally significant flora, and good cover of common grasses, herbs and shrubs. The restoration work has elevated the site to one of the most significant and high quality stands of Valley Grassy Forest in Victoria (pers. comm., Cam Beardsell, Parks Victoria).

An area of untreated Valley Grassy Forest adjacent to the fenced plot. Much of Latrobeana Terrace was previously covered in similar thick shrubland. Note the bare ground beneath the shrubs, caused by competition and grazing pressure. Photo: Karl Just

Areas where shrubs have been thinned have either slowly regenerated with indigenous grasses and herbs or were planted out. This has converted species-poor shrubland into areas supporting herb-rich ground flora.

The plantings have overall been very successful. Most plants grew rapidly once established because of the rich source of nutrients available on the ash beds. In the first few years many species began to recruit naturally by seed or through vegetative reproduction. There was also rapid natural recruitment at the burn sites from soil-stored seed that had been stimulated by burning or from surrounding plants seeding onto the ash beds. The result is that it is now difficult to tell that the plants have been planted at all. Scattered clusters of wildflowers are now attracting great numbers of native bees, butterflies and other pollinators.

All significant flora occurring within the site have now been successfully secured by halting threatening processes and increasing population size through planting.

Discussion

The burn pile technique has proven very successful and should be considered by other practitioners in the restoration field. In many ways this mimics a fire event by removing the thick shrub layer and replacing it with a herb-rich ground flora. It had the benefit over a planned burn by being more controllable and less difficult to organise. Fuel reduction burns can often have negative side effects (such as loss of ground logs and stags and through the creation of fire breaks) that could be avoided by using this method. It should be noted however that systems dominated by robust grasses are likely to require periodic burning or grazing to prevent excessive buildup of grass biomass.

Latrobean Terrace is of very high ecological significance, with over 215 indigenous flora taxa were recorded, including nine Victorian threatened species, two nationally threatened species and over 60 species that are regionally rare or threatened. Photo: Karl Just

There are few examples in the Melbourne area of projects that have successfully restored a plant community to such a high level. Many projects are restricted to merely removing weeds, without holistic approaches to combating threatening processes and enhancing ground flora. The project at Latrobeana Terrace demonstrates the importance of detailed botanical knowledge when attempting plant community restoration and threatened species recovery.

Acknowledgments

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Ex-situ conservation of the rare Tall Yellow-top Daisy (*Senecio pilosicristus*)

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Introduction

In South Australia, the Tall Yellow-top (*Senecio pilosicristus*) is a rare daisy which was historically collected in the Karoonda to Lameroo area in the Murraylands region of the state. The majority of herbarium collections for c were from the 1910s to the 1960s. Apart from a single herbarium collection from an unknown locality in 1984 there have been no further herbarium collections in SA. This species also occurs in western Victoria where it is considered very rare and it is currently listed as vulnerable in Victoria. There is little is known about the biology and habitat of the Tall Yellow-top.

The South Australian Seed Conservation Centre (SASCC), based at the Adelaide Botanic Gardens, is dedicated to the conservation of the state's threatened native plants. More specifically this includes locating plants and recording habitat details, collecting and banking seeds, research to determine germination requirements and the propagation of plants to assist with restoration programs. Staff at the SASCC identified the Tall Yellow-top as a priority species to locate and collect seeds. The historic location information and lack of recent records suggested that this species may occur on the more fertile loams that have since been cleared for cropping. Although there were no notes with herbarium vouchers to suggest that the Tall Yellow-top was collected post fire, it was suspected that the lack of records may indicate this species might only be detectable after environmental disturbance events such as bushfire.

Field searches

In recent years, staff from the SASCC have searched some of the historical South Australian localities for the Tall Yellow-top without success. The majority of the land where historic records were made has been substantially cleared for agricultural use and the fragmented remnant vegetation is highly impacted by numerous introduced plants and animals.

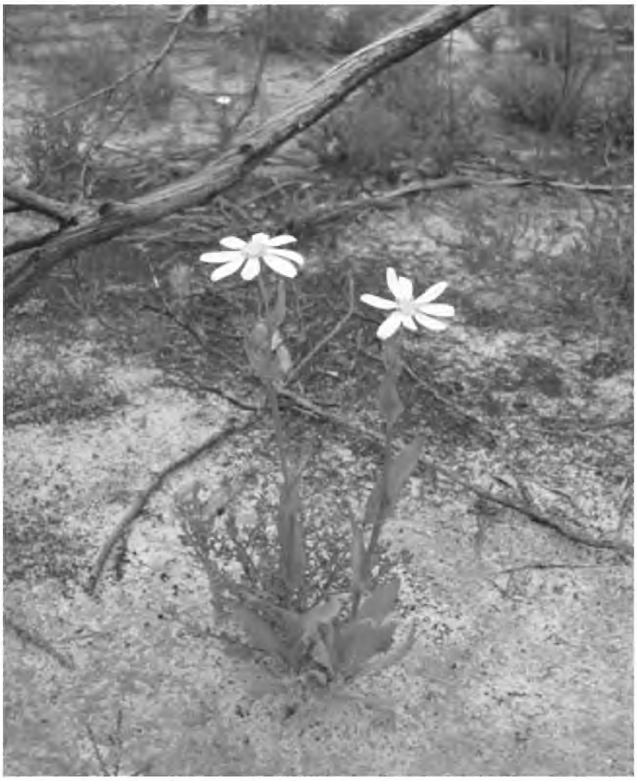
However in September 2010, a chance find of a post burn site in Billiat Conservation Park (CP) during field searches yielded success. A small population of the Tall Yellow-top was located in a mallee woodland fire scar growing in a low open swale on pale red sandy loams in regenerating mallee with other specific fire responsive species such as Small-leaf Ray Flower (*Cyphanthera myosotidea*), False Buckbush (*Gyrostemon australasicus*), Azure Daisy-bush (*Olearia rudis*), Branched Everlasting (*Coronidium adenophorum*), Oondooroo (*Solanum simile*), Cup Velleia (*Velleia connata*), Twiggy Lignum (*Muehlenbeckia diclina*) and Williamson's Riceflower (*Pimelea williamsonii*). This localised population contained at least a few hundred individuals. Apart from a sub-population of approximately fifty plants that was identified another 800 m north of the original population, no further populations have been recorded during follow up searches within a radius of 7 km. Photos of the characteristics of the plant such as flower, leaves and habit were taken along with pressed plant specimens in order to build knowledge about this daisy.

Regional staff working for the Department of Environment and Natural Resources (DENR) based in the area were made aware of this population and asked to monitor other post-fire mallee in the region for this species. A follow up visit to the population twelve months later (spring 2011) revealed a small number of plants resprouting. However these plants produced much less vigorous growth than observed during the previous spring immediately post fire. This observation suggests that although plants can persist for a second year post-fire, this species is quite short-lived.

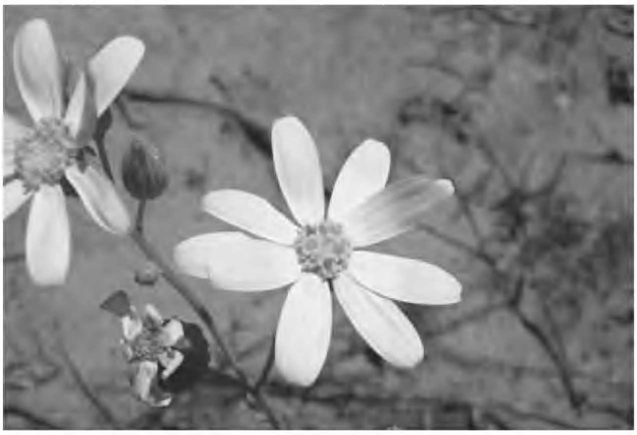
*Tall Yellow-top (*Senecio pilosicristus*) habitat in Billiat Conservation Park. This population was located in a mallee woodland fire scar growing with other specific fire responsive species. Photo: SA Seed Conservation Centre.*

Observations of the plant characteristics

The Tall Yellow-top is an erect, fleshy, glaucous, short-lived herb to approximately 70 cm tall. It has sessile, stem clasping, tapered-lanceolate cauline leaves on reddish purple stems with a basal rosette of lobed spathulate leaves. Flowers are a yellow daisy up to 50 mm in diameter with up to ten ray petals. The seeds are a brown achene with longitudinal ridges of white hairs and white pappus.



*Tall Yellow-top (*Senecio pilosicristus*) plant observed in 2010. Photo: SA Seed Conservation Centre.*



*Tall Yellow-top (*Senecio pilosicristus*) flower. Photo: SA Seed Conservation Centre.*

Germination research

The SASCC collected and banked more than eight thousand seeds for this rare daisy in 2010 and has undertaken research to determine its germination requirements. Germination screening was undertaken for this species in both winter and spring diurnal conditions using gibberellic acid, potassium nitrate and untreated controls. Gibberellic acid is a naturally occurring plant growth hormone which can alleviate seed dormancy in some species. Potassium nitrate was used because the availability of free nitrogen post fire as nitrates in the soil can act as a 'gap detection' signal and provide a cue for seed germination. No germination was recorded for the untreated controls or the seeds which received potassium nitrate treatment in either winter or spring conditions. Whilst only a single germinant resulted from gibberellic acid treatment in spring conditions, a germination rate of 42% was achieved with gibberellic acid in winter conditions. These results suggest the Tall Yellow-top specifically prefers winter conditions for germination. Further research is required to ascertain the germination response to environmental cues such as heat and smoke chemicals.

*Tall Yellow-top (*Senecio pilosicristus*) seed.*
Photo: SA Seed Conservation Centre.

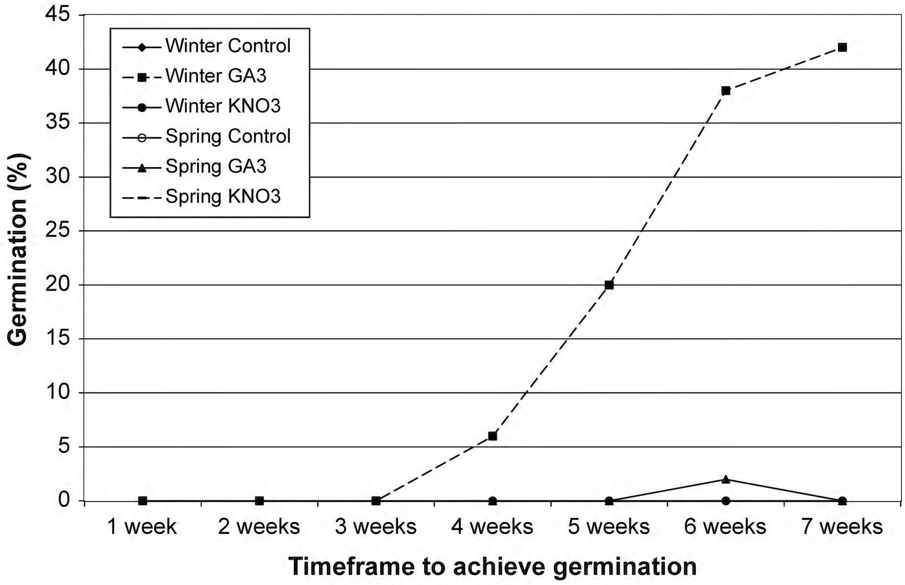
The future

Staff at the SASCC anticipate that more populations of the Tall Yellow-top will be observed in post fire mallee in the region. The DENR regional ecologist working in the Murray region has identified and mapped further areas of mallee for prescribed burning which may be potential habitat for the Tall Yellow-top. Regional staff and the SASCC will perform further searches in spring 2012 upon completion of prescribed burns for Billiat CP scheduled for autumn 2012. In addition to the Tall Yellow-top, this will be an opportunity for regional and SASCC staff to monitor for other fire responsive species such as the nationally vulnerable Yellow Swainson-pea (*Swainsona pyrophila*) and Showy Lawrencia (*Lawrencia berthae*) which is listed as rare in South Australia and vulnerable in Victoria.

Field observations of the Tall Yellow-top and the collation of valuable information about the biology and habitat of this daisy have been shared with interested parties, including the DENR regional ecologist. This will increase the chances of finding additional populations. Future germination experiments utilising fire related treatments such as heat and smoke may provide an opportunity to understand environmental germination cues and techniques for growing plants for regional restoration projects.

Acknowledgements

We would like to acknowledge the support of the Native Vegetation Council which has enabled the SASCC to perform project work in the Murray region. We would also like to acknowledge the assistance of Thai Te, Jenny Guerin, Ellen Ryan-Colton and Denzel Murfet during field searches and laboratory work.



*Germination results from testing Tall Yellow-top (*Senecio pilosicristus*) seeds. Key: GA3 = gibberellic acid; KNO3 = potassium nitrate treatment*

Revegetation of Banksia Eucalypt Woodland in Beeliar Regional Park, Western Australia

Linda Metz

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Introduction

The City of Cockburn's revegetation program focused on reinstating important Banksia Eucalypt woodland communities at two locations to link corridors of vegetation and provide foraging habitat for threatened bird species. Two sites were selected in 2010 for revegetation. The sites are both located within the Beeliar Regional Park and managed by the City of Cockburn.

Local government has a significant role to play in restoring and revegetating areas especially those which are under pressure from multiple threats and located in close proximity to urban centres. By harnessing the energy of the community and engaging them through education, improved long term benefits for both fauna and flora can be achieved and these patches of remnant bushland are more likely to be protected.

Background and Objectives

The sites for revegetation occur on the Swan Coastal Plain, one at Bibra Lake and the other at Yangebup Lake, with both sites occurring on Karakatta soils. Each site is geographically located upland to nearby wetlands and has been subject to significant historical disturbance including clearing for timber and grazing (Strategen 2009).

Given that the Bibra Lake site supports existing Banksia Eucalypt woodland vegetation and that this location is known to provide foraging and roosting sites for Black Cockatoos, whose range has contracted by more than 30% since the 1950s (Garnett and Crowley 2000), providing additional foraging habitat for this species became one of the key objectives for this project.

The upland communities at these sites were both structurally altered with the complete loss of understorey and in some cases only a few mature Eucalypt species remained. A significant weedy understorey had replaced natives consisting predominantly of Veldt Grass (*Ehrharta calycina*) and other weeds such as Geraldton Carnation weed (*Euphorbia terracina*) and Lupins (*Lupinus cosentinii*).

The sites are located within reserves which have in some parts tested either positive or uninterpretable to phytophthora fungus (*Phytophthora cinnamomi*) and as such impacts of possible dieback within the sites had to be considered. Assessments of proximity of dieback fronts to sites and condition of nearby remnant woodland suggested that the Bibra Lake site was not positive but that the Yangebup Lake site was likely to be positive. This had implications on species selection.

The project had three main objectives:

- to revegetate areas and reinstate Banksia Eucalypt woodland community;
- to provide foraging habitat for Black Cockatoos; and
- to improve ecological linkages.

Methods

The majority of the revegetation work occurred in 2010, which also proved to be one of the driest years in Perth, experiencing below average rainfall (DOW 2010).

Completion targets were set at both sites to help guide revegetation actions and measure success. This included final plant density of 1.6 plants / m^2 and 70% species diversity represented at the end of 12 months. Should any of these measures not be met remedial actions are triggered including infill planting. Monitoring of sites occurred on a monthly basis.

Prior to planting, weed control was undertaken at both sites. With depleted native soil seed banks the Veldt Grass at the Bibra Lake site was under no competitive pressure and as such this weed species dominated. The absence of native understorey allowed for a broad scale weed control using non-selective herbicide to be applied. In The Yangebup site weed control had been undertaken for 12 months prior to planting and targeted Vetch (*Vicia sativa*) and Rose Pelargonium (*Pelargonium capitatum*).

Past land use at both locations had resulted in a degree of soil compaction which in addition to the inherent moisture repellence in Karrakatta soils, as is common on the Swan Coastal Plain (Ramsis et al. 2005), made it necessary to rip the site prior to undertaking any planting. This physical disturbance allows better moisture and root penetration.

The likely presence of *P.cinnamomi* within the Yangebup Lake site had immediate implications for species selection, with an acknowledgement that the Yangebup Lake site was unlikely to support high numbers of Proteaceae species such as *Banksia attenuata* or *B. menziesii*, which are common in other parts of the reserve. Lists of species which have been determined to be either susceptible or resistant to the effects of dieback were consulted to best inform species selection for the Yangebup Lake site (Groves et al).

Each site was planted out with a high density of plants. Even though planting heavily can result in increased competition between plants for moisture and nutrients, due to the high weed seedbank contained within the soil and previous observations of the benefits of creating microhabitats which are beneficial for plant establishment, plants were planted at a rate of 2 plants/m^2. Higher density of native plants will increase competition and reduce the availability of nutrients and moisture for weed species.

Species selection focused on establishing key successional species to help create the corner stone flora which will subsequently be built upon through future infill planting to achieve a representation of floristic species which would be common to Banksia Eucalypt woodlands. These included *Eucalyptus gomphocephala*, *Allocasuarina humilis* and a suite of *Acacia* species.

Each plant had soil conditioner applied to help reduce soil moisture repellence and improve root production and a tree guard installed to reduce likelihood of predation by local rabbit population.

After planting, a 100 mm layer of mulch was applied. Mulch has proven within several revegetation sites to be helpful in not only retaining soil moisture and keeping growing roots cool during summer but also for improving soil biota which is critical for successful establishment.

Benefits and outcomes

A range of challenges were encountered during this project. Plants were subject to frost events, low rainfall during winter and a very hot subsequent summer, in addition to difficulties of securing local provenance seed for a project of this scale. While survival rates were low during the first year of establishment, subsequent infill planting in 2011 performed well and as a result plant density and diversity targets were met.

It was observed, in comparison to other sites, that mulching had provided a positive impact with better moisture retention. The addition of leaf and organic material, provided by the mulch, seemed to also have a positive correlation to reptiles utilising the site.

Revegetation at Bibra Lake: This area was once dominated by the exotic Veldt Grass but following broad scale weed control, has been replanted with key successional species for Banksia Eucalypt woodlands. Photo: Linda Metz

Community involvement

Much of the success of these two revegetation projects is due to the involvement of local community members. Not only through labour during planting but in particular the Lake site has benefited from community members undertaking monitoring of fauna activity and general plant health.

Future work

Additional revegetation activities are planned in 2012/13 to build on current works primarily to expand the areas of Banksia woodland into currently degraded sites.

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Restoring the canopy health of native urban bushland and parkland trees

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Introduction

The population of Western Australia's capital city, Perth, is rapidly expanding and will continue to do so over the coming decade. In comparison to capital cities of the eastern states, the density of people per square kilometre is low. These trends are often portrayed in the media and the business sector as good, however, what does this all mean for native trees in urban bushland and parklands? The canopy cover of this native vegetation has dramatically reduced over recent years largely as a result of property development, and what remains has become increasingly fragmented and is in a very poor state of health, due to a range of factors. Urban bushland restoration is traditionally viewed in the context of weed control, and revegetation, but what about the restoration of the health of the existing canopy tree species? This article briefly discusses the causes of decline of these species, the importance of restoring their canopy health, and novel methods that have been applied to do so.

Causes of declining canopy health

In the early 1990s, Manion and Lachance (1992) suggested three categories of factors played a role in forest declines; predisposing, inciting and contributing. The urban environment was listed as one of the factors predisposing trees to premature decline. Many of our remnant trees residing in urban bushland and parklands may be predisposed to crown decline due to exposure to air pollution, nutrification, altered drainage, or increased heat exposure. Other factors may incite or trigger the onset of decline, including climate change, extreme weather events, mechanical damage (i.e. from urban development or over-pruning), or diseases. Finally, a range of pests and diseases can contribute to this decline to a point where risk of limb failure due to decay can reach an unacceptable level.

Native canopy tree species are suffering from a decline in health from factors indirectly related to the demand for resources (i.e. groundwater abstraction), or a lack of adequate protection prior to and during the development process. There are numerous examples of native bushland trees retained within developments, but not afforded the adequate protection they require to survive in their new surroundings, only to die a slow or sudden death. These large, remnant, declining trees become a burden on society, requiring the annual removal of dead wood in their crowns due to a perceived risk of failure from decay. These trees no longer provide a service to their surrounding ecosystem and sequester large amounts of carbon, they now become a source of carbon via their decaying limbs and the associated emissions from the heavy machines that maintain them.

Many inciting factors in urban bushland can be prevented. For example, the introduction of pathogens that can incite premature decline may be prevented through good hygiene practices. This is a more cost effective means of managing such assets and preserving the biodiversity than attempting to control such diseases once they have entered.

Throughout urban bushland of Perth many *Eucalyptus marginata*, *E. gomphocephala* and *Corymbia calophylla* are suffering from severe crown decline. Our surveys over the past 18 months throughout many sites have revealed a range of anthropogenic and biological factors contributing to the decline of these species. This includes the isolation of eight *Phytophthora* species, with three of these new to science. The distribution, host range and pathogenicity of most of these species is largely unknown.

A lack of tree protection around this former bushland Eucalyptus gomphocephala *(Tuart) within a new urban development causes major damage to the root system and subsequent decline and death. Photo: Paul Barber*

Restoring canopy health

Traditional methods

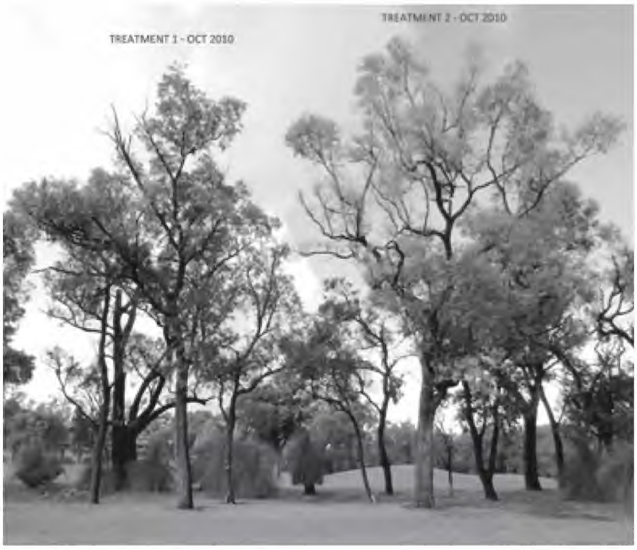
Often the removal of canopy species in urban bushland is justified by replacement with multiple seedlings. These seedlings will take many years if not decades to become mature canopy trees, and during that time they will need to overcome all the predisposing, inciting and contributing factors imposed upon them to reach full maturity with healthy crowns. The management of these seedlings, may require many years of weed control, watering, fertilizing, pruning and general care. Such management is energy and carbon intensive, and requires considerable resources.

Current management of declining urban bushland trees is mostly limited to the annual removal of deadwood, thinning of the crowns to stimulate new growth, and eventually entire tree removal once they have suffered severe crown decline. Continual removal of deadwood again is energy and carbon intensive, and expensive. The thinning of tree crowns stimulates new foliage growth at the expense of allocating resources to defend against pests and diseases. The cause(s) of the crown decline can therefore be favoured by the removal of healthy limbs.

A new approach

Over recent years we have adopted a novel and alternative approach to the management of native urban trees suffering from continual canopy decline. In addition to the removal of the impacting anthropogenic factors, correct diagnosis of the biological factors, including a range of pathogens, pests and nutrient disorders, has guided the selection and application of a range of systemic treatments to mitigate crown decline and improve crown health.

The correct diagnosis has enabled the selection of a range of slow release systemic implants applied to the stem to improve crown health. This application method has many benefits when compared to soil applications, including efficient and reliable uptake, minimal resources and tools, and no exposure to chemicals. Sometimes the application of soil treatments is not always possible due to surrounding impermeable surfaces. The improvement in crown health is sometimes evident within weeks of application, with noticeable improvement in foliage colour and crown density within months. The improvement in crown density increases photosynthetic capacity of the trees, presumably resulting in translocation of nutrients to the root system and improvement in root health. Mitigating crown decline of mature trees in this way is much more cost-effective than annual pruning of dead wood, and has the potential to greatly reduce the number of mature canopy trees that succumb to the chipping machine. It also delays further decline while the exact etiology is determined. Where possible, a holistic approach should be adopted whereby these systemic treatments are used in conjunction with soil amendments and the removal of impacting anthropogenic factors.



A remnant stand of Eucalyptus marginata *(Jarrah) treated with differing systemic treatments show the difference in crown colour (left) of the tree treated with the correct compound compared to the tree treated with an ineffective compound (right). Photo: Paul Barber*

Conclusions

Current management of declining trees is mostly limited to the annual pruning of deadwood, thinning of crowns, and eventual tree removal once they are deemed to be an unnecessary risk. Our recent surveys have revealed a range of anthropogenic and biological factors associated with declining trees. Correct diagnosis of the cause(s) of decline, and selection and application of a holistic approach which includes the application of systemic implants can mitigate crown decline and improve crown health. Such novel approaches to the management of mature native trees in urban bushland environments can have great environmental, economic and social benefits.

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The Redhand Method™ - a new method of herbicide application

Tait Bedlington

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Introduction

When introduced to the splatter gun technique of herbicide application over five years ago by a colleague involved in the early splatter gun trial process, I was extremely enthusiastic at the prospect of being able to remove Lantana more efficiently and effectively than ever before. Through experimentation, I was able to further improve on the results through the development of the Redhand Method™, an integrated approach to Lantana removal for bush restoration that evolved from the splatter gun technique.

Splatter Gun technique

The splatter gun method involves applying a low volume of concentrated herbicide mix to foliage. A specialised gun (gas powered or manual drenching gun) and specialised nozzle produces large droplets of herbicide that can be applied from a distance of 6-10 m away. Only a small portion of the foliage needs to be sprayed so off target damage can be minimised and this technique is particularly useful in areas of difficult access or sensitive vegetation.

Method:

- splatter or gas gun rate of Glyphosate 360 g/L 1:9 glyphosate: water, applied at a rate of 2 x 2 ml doses per 0.5 m of bush height;
- a marker dye is recommended to identify splatter bushes;
- apply approximately 15-20 ml of herbicide mix per splatter on large bushes to achieve the registered rate of 2 x 2 ml per 0.5 m of bush height;
- arc the spray over the top of the bush and down the front face and if treating dense Lantana, apply one splatter every two strides, with an occasional horizontal pass low across the front edge of the bushes to treat any seedlings;
- as with all herbicide treatments, apply to actively growing plants with full foliage;
- like all Lantana controls, follow up treatments are recommended to control seedlings and/or regrowth.

Advantages:

- good where dense vegetation or Lantana prevents other conventional methods being used;
- good where inaccessibility means mechanical methods cannot be used;
- delivers small volumes of concentrated herbicide to reduce chemical usage and off-target damage;
- only a small portion of the foliage needs to be covered, so useful in areas of difficult access or sensitive vegetation;
- can be applied using the 5L back pack on foot, from a vehicle or horseback;
- minimises direct soil disturbance;
- good for low to medium density Lantana;
- good around watercourses;
- comparatively large areas can be treated per backpack of spray due to small volume of high concentration mix applied;
- a manual drench or gas powered set up are commercially available.

Disadvantages:

- when using non-selective herbicides, there may be off target damage if not applied carefully.

Development of the Redhand Method™

Although the splatter gun technique delivered, I quickly discovered that, in relation to commercial bush restoration, there are some additional disadvantages that are not commonly sighted in the few resources to be found on this technique. These include:

- the cost of purchasing specialised equipment, especially the gas powered version;
- the additional cost (and in my opinion waste) in the release of propane gas to eject each dose;
- on-site gas bottle refilling;
- the tendency for the gas gun to literally freeze up, slowing work rates;
- limited 5L size of backpack;
- more down time filling and swapping out backpacks and gas bottles;
- set dose delivery system at a set pressure for gas gun;
- tendency to overreach and spray Lantana without clear sight leading to off target damage;
- despite the specialised nozzle the gas gun produced fine droplet drift; and
- Lantana spreads through and up into desirable species, increasing off target damage.

Whenever I used the gas gun I kept running into these same problems. So in resolving each I came to develop a method that acknowledges the best principles and advantages of the splatter gun technique while developing versatility, effectiveness and efficiency. The development of a new tool has led to a new method of treatment.

The basic principle of the splatter technique is the delivery of a set quantity of concentrated herbicide with large droplet size, ideally, in the absence of small droplets capable of drifting. This delivers the herbicide in a way that reduces the likelihood of sending the bush into shock, increasing the total amount absorbed and circulated within the plant.

So the first development was finding a way to replicate the stream that the drenching guns deliver using my solo backpack. After many experiments involving different combinations of custom and off the shelf nozzles and spray additives to manage droplet size, I have settled on describing the cheapest and most readily available combination. All of which can be purchased from your local rural store. Although this set up is less efficient and effective than later versions I am now developing commercially, it still delivers significant improvements over the splatter gun technique.

The equipment:
- 15 L solo or similar backpack;
- brass adjustable nozzle.

The mixture:
- 1:9 glyphosate : water. I prefer a glyphosate listed for use in and around waterways;
- marker dye;
- 1.5-2.5 ml/L Protec Plus- penetrant, surfactant, droplet management.

The method:
- same basic application technique and rate as for the splatter gun, and then adapting the chemical application technique to the changes in weed distribution and density. This change alone provides increases in effectiveness and efficiency;
- attempt to hit every target weed and avoid hitting anything else. The tension between these ideals provides the best results;
- work is undertaken in systematic staged blocks that vary in size but equate to the area I can thoroughly treat in one day. Targeting the areas of highest weed density first and then the surrounding lower densities within work blocks. Such that the greatest impact on the target population is being achieved at any given time;
- treat areas where yellowing off is evident to monitor and touch-up poorly controlled, missed or emergent weeds; and
- monitor and review the effectiveness and efficiency of control methodology, maintenance of adequate pace and quality of works to achieve targets and desired outcomes.

The Redhand method provides a new way to control Lantana camara. *Photo: Murray Fagg*

Advantages:
- better recovery rates for native species after treatment;
- the ability to adjust the delivery pressure;
- with training and some practice you can achieve very high levels of accuracy in dose and on target delivery, while retaining the 6-10 m reach of the gas powered gun if needed;
- far more versatile across the full range of Lantana bush habits, densities and sizes. From the small and spindly or enmeshed bush, right through, to the big impenetrable thickets;
- better targeted and more thorough primary treatments;
- fewer passes required;
- 10-15 L backpack gives less down time for refilling and covers more ground;
- easier and cheaper maintenance than the gas powered drenching gun;
- very low off target damage (far lower than splatter gun);
- reduction of fine droplets prone to drift where cleanliness and maintenance of equipment is observed; and
- allows the opportunity to use cut stump method without need for a separate pass.

Conclusion

In bush restoration the greatest cost by a large margin is labour. Using this method I have been able to achieve consistent project average costs of on-ground works of $1000/ha (in a moderately disturbed forest environment with a range of weed densities) including chemical and GST, treatment takes 22 hrs/ha and 6 L glyphosate/ha. This is a considerable achievement because it achieves better quality environmental outcomes cheaper than the splatter gun technique. This, of course, recognises that every site has a unique set of restoration goals and challenges.

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Report from New Zealand Plant Conservation Network

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Partnership with Kew's millennium seedbank

In April, at the Auckland Botanic Gardens, Philippa Crisp, President of the NZPCN signed Kew's Millennium Seed Bank agreement with Dr Paul Smith OBE from MSB, making New Zealand the 55th country to join. This is a step towards reaching Target 8 of the Global Strategy for Plant Conservation where at least 75% of threatened plant species are in ex situ collections. The Margot Forde Germplasm Centre in Palmerston North would serve as the main repository and Botanic Gardens of New Zealand are seeing how they can play a part in this.

Plant threat to coastal ecosystems

Sea spurge (*Euphorbia paralias*) has recently been found growing near the mouth of the Waihi Stream, near Aotea Harbour on the west coast of the North Island. It has not previously been recorded as naturalised in New Zealand. It is thought that the seeds travel in the oceans currents and can survive for months or years at sea. If allowed to establish it would displace native plants and natural patterns of sand movement. Although this is the only place that it has been found, there is the possibility that it could establish along the west coast of the North Island.

Network/website updates

The Network has launched its online flora mapping system, providing information about the distribution of plant species and the flora sites throughout New Zealand. The system has taken two years to build and has been made possible with the sponsorship from the Department of Conservation, the support of Graeme Jane (who provided his national plant list database) and the many network members recording their phenology observations during this time.

And lastly as mentioned in our last report, our upcoming conference will now not be held at the end of this year, but will be next year to coincide with our 10th year anniversary.

Visit www.nzpcn.org.nz for more information.

Recent workshop reports

ANPC workshop report:
Translocation of threatened plants
Canberra, March 2012

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ANPC's 2012 Canberra Translocation Workshop was attended by around 40 participants from the ACT, NSW and Qld. Participants enjoyed a range of networking opportunities and left with a sound understanding of the role of translocation in the conservation of threatened plants.

Day 1 – Theory and local case studies

The first day of the workshop was held at the Australian National Botanic Gardens and focused on theory and highlighted a range of lessons learnt from local case studies.

Bob Makinson and myself, both the authors of the ANPC *Guidelines for the Translocation of Threatened Plants,* opened the workshop with an overview of the theory. Topics covered included introduction to translocation and deciding whether to translocate; and pre-translocation assessment, planning & preparation.

A selection of local experts and practitioners then presented translocation case studies.

John Briggs, from the Office of Environment and Heritage (NSW), highlighted lessons learnt during translocation projects for two threatened grevilleas: the Wee Jasper Grevillea and Tumut Grevillia. On day two of the workshop, John lead a tour of the North Watson Woodland where a rehabilitation project is underway for the endangered Yellow Box – Blakely's Red Gum Grassy Woodland. Lessons learnt from this project are similar lessons to those resulting from the endangered grevillea translocations, including that plantings need to occur across multiple habitat types and also across multiple years to maximise chances of success.

Andrew Young, from the Centre for Australian National Biodiversity Research, spoke about integrating genetic & demographic data into translocation planning for

Recent workshop reports (cont.)

Rutidosi leptorrhynchoides. Participants visited two populations of this endangered grassland daisy on day two of the workshop, where Andrew discussed the implications of his long term research for planning restoration and translocation projects, including that we may in some cases be too cautious about not mixing populations.

Chris Howard, from the Centre for Australian National Biodiversity Research, presented an overview of orchid translocations associated with the Bulahdelah bypass and Rainer Rehwinkel from the Office of Environment and Heritage (NSW) then spoke about translocation of the Aromatic Peppercress (*Lepidium hyssopifolium*) in the Southern Tablelands.

Greg Baines, from the ACT Government, presented the final case study, highlighting lessons learnt from translocation projects for a range of threatened plant species in the ACT, including the Tuggeranong Lignum (*Muehlenbeckia tuggeranong*), which we were lucky enough to see *in situ* on day 2 of the workshop in its precarious riparian habitat.

Simon Nally from the Department of Sustainability, Environment, Water, Population and Communities, spoke about assisted colonisation. There has been a recent increase in discussions surrounding the use of assisted colonisation (also called assisted migration and managed relocation) to assist species to adapt to climate change induced habitat change, so it was great to have Simon talk about the policy changes required to facilitate such translocations.

The day closed with a workshop activity where participants were able to test some of their new found knowledge and learn from the experience of other participants.

*David Taylor at the Australian National Botanic Gardens nursery talking about a translocation project for the Small Purple-Pea (*Swainsona recta*). Photo: Tricia Hogbin*

*Participants at Pine Island, the site of a translocation project for the endangered shrub— Tuggeranong Lignum (*Muehlenbeckia tuggeranong*). Photo: Tricia Hogbin*

Day 2 – field trip

First stop on day two of the workshop was the Australian National Botanic Gardens nursery facilities, where nursery staff highlighted the nursery's phytosanitary processes. We also heard about a selection of translocation projects for threatened flora.

Second stop was Pine Island, where Greg Baines took us on a tour of one of the translocation recipient sites for the Tuggeranong Lignum. Greg highlighted lessons learnt, including the importance of being able to manage original threatening processes if translocation is to succeed.

We then visited two translocation sites for *Rutidosis leptorrhynchoides* and the North Watson Woodland as discussed above.

Future ANPC translocation workshops and additional information

A Sydney translocation workshop is scheduled for early November 2012 and a workshop will likely be held in south-east Queensland in early 2013. To be notified when registrations open subscribe to ANPC News at anpc.asn.au.

The workshop registration fee includes a free CD copy of the ANPC *Guidelines for the Translocation of Threatened Plants.* The Guidelines can also be ordered from anpc.asn.au by selecting the publications tab on the left.

Additional images of this workshop and other ANPC events can be viewed at http://www.flickr.com/photos/anpc/.

Recent workshop reports (cont.)

Fungi Festival 2012
Hobart, 26-29 April

Tom May

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Fungi Festival 2012, recently held in Hobart, Tasmania (26-29 April), attracted around 200 participants, including researchers, field naturalists, land managers, rehabilitation practitioners, biological farmers and food-lovers. The Festival included a two-day Symposium on the Conservation and Management of Fungi, a debate on eating wild fungi and a weekend of forays and workshops.

Presentations during the first day of the Symposium provided overviews of the diversity and roles of fungi in ecosystems. Trophic (nutritional) groups covered included mycorrhizal fungi, lichens, saprotrophic (decomposer) fungi and pathogens. Interactions with other organisms were highlighted, from the almost universal association of green plants with mycorrhizal fungi to mycophagy (fungi eating) by mammals and invertebrates. The detrimental effects of fungi were also covered, with presentations on weedy ectomycorrhizal fungi (for example Fly agaric) and exotic pathogens of plants (Cinnamon fungus and Myrtle rust) and animals (Frog chytrid fungus).

A theme running through all presentations was that fungi are a separate kingdom of the natural world with unique structures, life cycles, modes of nutrition and ecological roles. Plumbing pipes, wool and sock puppets were used to demonstrate the tiny nature of fungal spores and hyphae in relation to plant seeds and roots; as well as sex in fungi (you'll have to come along to a future Fungi Festival to hear the details).

Management of fungi in natural ecosystems was considered from the point of view of fire and in relation to using vegetation as a surrogate for fungi (only realistic for common fungi). Peter Buchanan (Landcare Research, New Zealand) represented the newly formed International Society for Fungal Conservation. Peter shared his experiences of promoting the three F's (Flora, Fauna and Fungi) at meetings about the Global Taxonomy Initiative by giving away t-shirts featuring the slogan 'Fungi–orphans of Rio' (in reference to the 1992 *Convention on Biological Diversity* and its programs, where fungi are rarely mentioned). Alison Pouliot provided an overview of fungal conservation in Australia, and the day concluded with a discussion about developing a coherent strategy for the conservation of Australian fungi.

Lyn Abbott talking about arbuscular mycorrhzial fungi at the Symposium on Conservation and Management of Fungi. Photo: Tom May.

The second day of the Symposium focused on practical applications of fungi in areas such as mine site restoration, carbon sequestration, biocontrol (e.g. of locusts) and germination of rare orchids. There were also fascinating talks on the role of fungi in soil health, compost and food production. Walter Jehne gave a thought-provoking presentation that highlighted how fungi assist plants in selective nutrient uptake; and how the lack of fungi in many agricultural systems (due to high nutrient levels) can lead to a reduction in the nutritional value of food. The afternoon was spent in the Queen's Domain, with workshops and site visits.

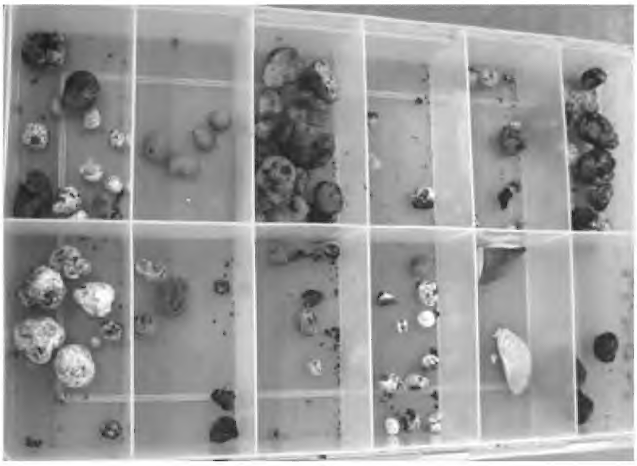
On Friday evening, the audience at the debate on the topic of 'Eating wild fungi: fun or foolhardy' were treated to an entertaining and eclectic mix of opinions about the topic. Audience acclamation clearly supported the 'fun' side. Nevertheless, the debate provided interesting perspectives both about the benefits of encouraging a connection with fungi (as food), but also about the difficulties resulting from the mismatch between cultural knowledge of fungi learnt overseas and the Australian environment (with its unique mycota).

Over the weekend there was a variety of forays and workshops aimed at both beginners and also those with an interest in fungi who wished to gain further skills, such as in fungi and lichen identification, setting up surveys for fungi or documenting fungal collections for herbaria. Forays were held on Mount Wellington, and included a children's foray—with demonstrations of puffing puffballs and writing on artist's conks as well as a hunt for tiny, slimy and smelly fungi. Workshops held at the University of Tasmania enabled use of microscopes for sessions on identification of mushrooms, polypores, disc fungi, the genus *Entoloma* and of truffles and their spores in mammal scats.

Recent workshop reports (cont.)

The finale to the Festival was a collecting expedition to the Tarkine region of north-west Tasmania, based at Corinna, on the Pieman River. Royal Botanic Gardens Melbourne staff joined a dozen mycologists and photographers from across Australia to document the macrofungi of the Cool Temperate Rainforest of the Tarkine. More than 200 species were recorded over three days. The extensive areas of rainforest (the largest tract of temperate rainforest in the Southern Hemisphere) harbour few green plants but are megadiverse for bryophytes, lichens and macrofungi. More than 50 people travelled to Corinna on Friday and Saturday 4-5th May to hear a lecture on ‘Natural History in the 21st century’ and participate in further forays and workshops, including a session on slime moulds held in the dining room of the Tarkine Hotel.

Fungi Festival 2012 was organised by Fungimap and NRM South (the natural resource management agency for southern Tasmania) and the Corinna activities were supported by Cradle Coast NRM. The success of Fungi Festival 2012 suggests that it could become a regular event. In addition to the demand for training and learning opportunities about fungi, there is certainly a need for further discussions and education about utilising fungi in restoration and bioremediation, and in connecting researchers and practitioners in these areas.



Various truffles and other fungi examined during the workshop on identification of spores in mammals scats, University of Tasmania. Photo: Tom May.

Book reviews

Flammable Australia
Fire Regimes, Biodiversity and Ecosystems in a Changing World

by R.A. Bradstock, A.M. Gill, R.J. Williams (Editors)
CSIRO Publishing, 344 pages with colour photographs and illustrations
Paperback, ISBN: 9780643104822
Price: AU $79.95
Available from: www.publish.csiro.au

Flammable Australia: Fire Regimes, Biodiversity and Ecosystems in a Changing World integrates current knowledge of the way we understand, view and manage fire in Australia, providing an up to date synthesis of novel science and arising challenges. Many revered Australian scientists specialising in fire ecology contribute as writers or reviewers to the strong and diverse collection of articles addressing the ever growing and complex science of fire ecology and management.

From the front cover to the back, this book certainly presents well. The succinct informative title is easy to read and reference and the snazzy cover is instantly attractive.

The book is accessible with easy to read print and a compact, yet reader friendly size. Many of the chapters give a broad overview of the set topic but also deliver specific details and examples. The generous colour figures, including photos, graphs and maps, along with the tables, add clarity and provide interest. Furthermore each of the chapters is well referenced with individual chapter lists providing a valuable tool for further reading and research.

The first section of the book, Evolution and Prehistory, contrary to its title is surprisingly modern. The first chapter provides a great introduction to the book, expertly analysing and interpreting paleo-environmental information to show the story of fire during the last 150 000 years. The authors demonstrate how understanding the interactions between fire, biomass, temperature and rainfall in the past, provides a valuable tool for predicting fire in the future, enabling us to better understand the impacts of climate change and land management on fire. In the following chapter, the role of fire in shaping the Australian biota is explored. Theories of

Book reviews (cont.)

fire adaptation, and the evolution of flammability and fire traits, with an in depth look at the evolution of epicormic buds, are the initial focus followed by a thorough discussion of the impacts of human fire management on the Australian biota.

In the section entitled Processes, the links and interactions within fire ecology are examined. From the relationship between fire behaviour and the three major fuel types that make up fire-prone ecosystems, to applying remote sensing as a tool to manage fire through detection and mapping, and the influence of global change on fire, this section is rather eclectic. The links between fire and soil-based processes, and a review of functional traits that influence response in both flora and fauna, were particularly refreshing topics that are not dealt with in other publications.

The following section reviews the interaction between fire and the dominant ecosystems of Australia; tropical savanna, hummock grasslands, Acacia shrublands, shrubby heaths and woodlands, southern forests, grasslands and grassy woodlands. Here we see discussion on such topics as effects of fire on boundary dynamics, the distribution and structure of ecosystems, and biodiversity.

The final section deals with rising challenges. The topics of carbon stocks and transfers, indigenous ecological knowledge and future land management are debated in the context of fire. The final chapter effectively compiles the ideas presented throughout the book. A series of pertinent questions in relation to fire management are proposed and the answers ultimately provide insight into the politics and science of fire and describe what is needed to create a new vision for fire management in a changing world.

Overall, this book is informative, well-written, current, and provides a comprehensive resource for all who are interested in the science of fire and how it affects the Australian environment, both now and into the future.

Dr Bryony Horton, Office of Environment and Heritage, Coffs Harbour, NSW.

Burke and Wills
The Scientific Legacy of the Victorian Exploring Expedition

by EB Joyce and DA McCann (editors)
CSIRO Publishing, 368 pages with colour illustrations
Hardback, ISBN: 9780643103320
Price: AU $59.95
Available from: www.publish.csiro.au

The tragedy of the Burke and Wills expedition south to north across Australia is etched in the minds of white Australians as a lesson in hubris and, as this book notes, ‘a compete débacle from beginning to end’. Much less known to the public, though, have been the substantial scientific results of this extraordinary adventure, now handsomely detailed in this volume.

Only one of the three scientists on the expedition survived, the Bavarian-born botanist, Herman Beckler, one of Ferdinand von Mueller’s protégés. Such was the organization of this venture that the scientists did not even get their instructions (reprinted here) until the expedition was about to leave Victorian soil. Burke’s priority was getting south to north and scientific work was hardly a priority for him; in fact, he severely restricted the scientists’ work, being ‘destitute of any enlightened scholarly vision’. At the end, there was supposed to be an official history of the expedition but even that never eventuated.

This book covers the whole story of the expedition but also in great depth the scientific results: geology and geomorphology, zoology, hydrology, meteorology and anthropology besides botany - all addressed by individual authors. Linden Gillbank covers the botany by putting it all in the context of Mueller’s hegemony in the 1850s while there is a particularly useful account of Beckler’s life, expedition collections and contribution to science. Some of his field landscapes and plant illustrations from the expedition are reproduced – some are coloured and have dates and localities (also reproduced here is a modern example by Mali Moir).

Falling out with the irascible Burke, Beckler resigned from the expedition early in its execution, but was detailed to remain at Menindee in western New South Wales. Nonetheless, he made about 1000 herbarium specimens from September 1860 to the end of June 1861. At his most industrious he was preparing 75 specimens a day, but he reached only as far north as Koorliatto Creek in what is now south-west Queensland. By then the expedition was falling apart through illness and deaths and so the medically trained Beckler was ‘now a factotum – physician, nurse, cook, washerwoman and, in an emergency, the sole defender of our lives and possessions’. Collecting only resumed on the way back, at Wonnaminta Creek. He then pulled together the meteorological observations (Ludwig Becker, whose responsibility this was, had died) and wrote

Book reviews (cont.)

a paper on the camels and also the plants collected from Pamamaroo Lake to Koorliatto Creek, sending all three contributions back to Melbourne. Periodically Beckler's materials had already been sent back to Mueller from the field and received enthusiastically with accounts appearing in the Argus newspaper. Mueller added known species to the government herbarium and also published new species in his Fragmenta phytographiae Australiae beginning in February 1861.

Despite the disastrous course of the expedition, Burke and Wills made the south-north crossing – and Victoria had beaten South Australia to it. But in Melbourne there was a clamour to apportion blame for the shambles and a Commission of Inquiry was set up in November 1861: Beckler was called to give evidence. The dead Burke took the blame for crass decisions but his failure to carry out the required scientific program was not criticized, despite his active opposition being recorded in Beckler's reports. The Exploration Committee was blamed for not acting on information sent back, information indicating the potential problems that would affect the safety and viability of the endeavour but, again, there was no criticism with regard to the Committee's failure to support the scientific part of the expedition. Commentators since have played down the scientific contributions altogether, so it is good to find in the closing chapters of this book the first reasoned assessment of this – in all its branches, as well as the art created by the expedition members, including Beckler.

The editors and other contributors are to be congratulated for putting a wrong to rights – in an erudite but immensely readable book.

David Mabberley, Royal Botanic Gardens and Domain Trust, Sydney, NSW

Conferences and Workshops

National Landcare Conference

3-5 September 2012
Sydney, NSW

The conference theme for 2012 is 'Landcare- the future in our hands'. With a growing interest in and concern for sustainable living and food security, the Landcare community is at the forefront of helping to ensure that Australia can move confidently towards a smart and resilient future for agricultural and environmental outcomes. The conference includes the following themes:

- Sustainable agriculture – e.g. innovative farm practices
- Biodiversity conservation
- Landcare engagement – e.g. youth, Indigenous
- Climate change and carbon
- Future of Landcare
- Policy and programs
- Stories you would like to tell - case studies sharing what did and didn't work
- Community resilience and action - e.g. Landcare, Coastcare, Bushcare, International Landcare
- Urban issues

For more information go to
http://www.daff.gov.au/natural-resources/landcare/national_landcare_conference_-_sydney.

19th Australian Orchid Council Conference and Show

11-16 September 2012
Perth, WA

The Australian Orchid Conference, held every three years, will be held in Perth this year. For more information visit http://www.waorchids.iinet.net.au/19th_AOC_Conference.htm

Coast to Coast 2012 – *Living on the Edge*

17-21 September 2012
Brisbane, Queensland

Australia's bi-annual Coast to Coast Conference provided a forum for those with an interest in coastal, estuarine and marine matters to meet and to share knowledge and experiences in the areas of management, science, policy, governance, advocacy and other related topics. For more information visit http://www.coast2coastaustralia.com/

Conferences and Workshops (cont.)

Government Sustainability Conference

18-19 September
Melbourne, Vic

The 2012 Government Sustainability Conference will provide local, state and federal government professionals and representatives of other public sector agencies with comprehensive analysis and advice about how to ingrain environmentally sustainable policies and practices within their organisations and the communities they serve. The conference will address environmental issues facing all levels of government, including:

- How to embed a culture of environmental sustainability within a government organisation
- Implementation of leading-edge climate change strategies that encourage reduced emissions and prepare a government organisation for the risks posed by climate change
- Community engagement in environmental initiatives.
- Encouraging sustainability in public sector infrastructure and the built environment
- Efficient water management practices and waste minimisation
- Green purchasing and procurement
- Policy and regulation adherence.

For more information visit
http://www.governmentsustainability.com.au

Oceania Section of the Society for Conservation Biology Regional meeting: People and Conservation in Land and Sea Country

21-23 September 2012
Darwin, NT

This regional conference on Conservation Biology in Oceania will focus on traditional land and sea management, by Indigenous people. This meeting will showcase Indigenous conservation management while highlighting the tools and knowledge now available to all conservation practitioners in caring for land and sea country For more information visit http://oscb2012.org/home

Australian Rangeland Society 17th Biennial Conference

23-27 September 2012
Kununurra, WA

This conference brings together managers, users and researchers of rangelands for discussion of 'hot topics' and current rangeland issues. The theme for the Conference is 'celebrating diversity: people, places, purpose'. Proposed topics for discussion include:

- strategic land and water use planning in northern Australia
- balancing pastoral, tourism, mining and conservation uses in the rangelands
- Indigenous land use and management
- latest techniques in grazing, biodiversity, fire and carbon anagement
- new science for rangeland management in a multiple use framework
- case studies in land restoration and land use change.

For more information visit http://www.austrangesoc.com.au/site/whatson_conference.php

Australasian Systematic Botany Society Conference

23-28 September 2012
Perth, WA

The conference theme (Local knowledge, global delivery) is inspired by the recent, landmark decision to allow electronic publication of new taxa and abstracts on biodiversity informatics, web-based collaborations, electronic publishing and eFloras are invited. Presentations on local endemism, pollination ecology and biodiversity threats such as climate change and plant pathogens are also encouraged.

The conference coincides with the height of spring flowering in the south-west of Western Australia and is also an excellent opportunity to visit the new Western Australian Herbarium, which has recently moved to a state of the art facility within the Western Australian Conservation Science Centre. Please visit http://www.asbs2012perth.com/ for further information.

Conferences and Workshops (cont.)

18th Australasian Weeds Conference

8-11 October, 2012
Melbourne, Vic

The Conference will showcase recent advances in weed science, extension and policy across Australian and international communities and landscapes. The Conference will focus on 'Developing solutions to evolving weed problems'. For more information visit the conference website http://www.18awc.com

Investing in environmental performance

15-17 October 2012
Adelaide, SA

SMI Knowledge Transfer are holding their inaugural workshop on Investing in Environmental Performance. The workshop 'aims to highlight the diversity and build awareness of the improvements in environmental management that are currently occurring in the Australian Resources Sector'. The list of topics includes'Managing Ecosystems – establishment and resilience'. More information, including a call for abstracts, can be found at http://www.jktech.com.au/investing-environmental-performance-sa

EIANZ Annual Conference

24-26 October 2012
Sydney, NSW

The Environment Institute of Australia and New Zealand annual conference will be held in Sydney in October. For more information visit the conference website http://www.eianz.org/eventsplus/category/environment-institute-annual-conference

2012 ANPC Conference

30 October – 2 November 2012
Canberra, ACT

The ANPC marks its 21st year in 2012. To celebrate the occasion, the 9th ANPC National Conference will:

- review and highlight plant conservation achievements in Australia over the last two decades
- evaluate the strengths and weaknesses of our existing approaches to plant conservation
- highlight current major issues facing plant conservation in Australia
- identify plant conservation directions in Australia for the coming decades.

The overall conference theme is plant conservation in Australia, achievement and future directions. Sub-themes include:

- threats
- conservation policy
- plant conservation strategies
- vegetation, soil and water context
- ecological restoration
- role of the NGO sector.

The conference will include invited key note papers, contributed papers, posters and workshops, as well as field trips in the ACT region to examine on-ground plant conservation activities. Registration for the conference is now open. Further information available at http://www.anbg.gov.au/anpc/conferences/2012/themes.html.

Information resources and useful websites

Australia's Weeds of National Significance grow by twelve

The Australian Weeds Committee has declared an additional 12 Weeds of National Significance (WoNS). Since its introduction in 1999, the WoNS initiative has assisted government and stakeholders to prioritise investment and provide strategic management of widespread weeds that have serious detrimental environmental, economic and social impacts. These additional weeds have been selected based on their economic, environmental and social impacts and their potential to spread:

- African Boxthorn
- Asparagus Weeds
- Bellyache Bush
- Brooms
- Cat's Claw Creeper
- Fireweed
- Gamba Grass
- Madeira Vine
- Opuntioid Cacti
- Sagittaria
- Silverleaf Nightshade
- Water Hyacinth.

For more information on Weeds of National Significance visit http://www.weeds.org.au/WoNS/index.html

Information resources and useful websites (cont.)

Literature review, translocations as a tool for biodiversity conservation during climate change

http://www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=1760

A literature review, commissioned by the Scottish Natural Heritage, reviews the application of species translocations as a conservation tool for the establishment or protection of populations in northerly and/or montane environments. The current generic debate concerning translocations and climate change is reviewed, and application of this technique to three species groups: lichens and bryophytes, vascular plants, and invertebrates considered. The application of various ecological modelling techniques to the issue of species translocation and climate change is also considered and key research questions that might be addressed by experimental study are proposed. The report can be downloaded from http://www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=1760.

Biological Control of Weeds in Australia

Mic Julien, Rachel McFadyen, Jim Cullen (editors).
CSIRO Publishing, 648 pages with colourphotographs and illustrations
Hardback, ISBN: 9780643099937, AU $180.00
Available from: www.publish.csiro.au

Biological control of weeds has been practised for over 100 years and Australia has been a leader in this weed management technique. The classical example of control of prickly pears in Australia by the cactus moth *Cactoblastis cactorum*, which was imported from the Americas, helped to set the future for biocontrol of weeds in many countries. Since then there have been many projects using Classical Biological Control to manage numerous weed species, many of which have been successful. Importantly, there have been no serious negative non-target impacts – the technique, when practised as it is in Australia, is safe and environmentally friendly. Economic assessments have shown that biocontrol of weeds in Australia has provided exceedingly high benefit-to-cost ratios. This book reviews biological control of weeds in Australia to 2011, covering over 90 weed species and a multitude of biological control agents and potential agents. Each chapter has been written by practising biological control of weeds researchers and provides details of the weed, the history of its biological control, exploration for agents, potential agents studied and agents released and the outcomes of those releases. The studies reported provide direction to future research and provide examples and knowledge for researchers and students.

Weeds of Northern Australia – a field guide

By Nicholas Smith
Published by Environment Centre, $25.00
Available from http://ecnt.org/weeds-field-guide

This field guide identifies high priority weeds threatening Northern Australia. This book is an essential field resource for seasoned land managers, those new to the issue of weeds and even gardeners wanting to know if plants growing in their garden are natives or weeds.

The field guide features:

- photos and descriptions for 150 weed species including detailed descriptions for 90 high priority species;
- species distribution maps;
- detailed botanical drawings;
- information on identification, flowering and fruiting time, preferred habitat, dispersal mechanisms and recommended control methods.

Up to date weed information was provided by the NT, Qld and WA governments, including weed management branches and Herbariums, the Department of Agriculture, Fisheries and Forestry's Northern Australia Quarantine Strategy, pastoralists, land management groups and Indigenous Rangers.

Plant Facts

by Camilla de la Bedoyere
Paperback, 40 page, illustrations and photographs
Miles Kelly Publishing £5.99

A new children's publication: *100 Facts - Plant Life* helps young minds to discover 100 amazing plant facts – from how species survive in different environments to the connections between plants, animals and humans. Activities, quizzes and cartoons adorn almost every page and are a great way to inspire interest in the fascinating topic of plants. The 100 plant facts are educational yet exciting and are aimed at children aged 7 to 10 years. The book includes illustrations and photographs, as well as projects to make and do. It helps children discover interesting facts such as how plants grow and breathe, why the titan arum flower is so smelly, what plant grows 30 cm in a single day, how cacti survive in scorching deserts and what plants enjoy meaty snacks. The book shows what steps people can take to make the future greener and how to live in harmony with plants – after all they produce the oxygen we breathe. This book is available from http://www.mileskelly.net/products-page/new-releases/plant-life/

Research Roundup

Compiled by Kirsten Cowley, Centre for Plant Biodiversity Research, Canberra.
Email: Kirsten.Cowley @csiro.au

Bhagwat, S.A., Breman, E., Thekaekara, T., Thornton, T.F. & Willis, K.J. (2012). **A battle lost? Report on two centuries of invasion and management of *Lantana camara* L. in Australia, India and South Africa.** *PLoS ONE* 7(3): e32407. doi:10.1371/journal.pone.0032407

Campbell, M.L., Clarke, P.J. & Keith, D.A. (2012). **Seed traits and seed bank longevity of wet sclerophyll forest shrubs.** *Australian Journal of Botany* 60: 96-103. http://dx.doi.org/10.1071/BT11261

Cardillo, M. & Meijaard, E. (2012). **Are comparative studies of extinction risk useful for conservation?** *Trends in Ecology and Evolution* 27(3): 167-171.

Ferris, G., D'Amico, V. & Williams, C.K. (2012). **Determining effective riparian buffer width for non-native plant exclusion and habitat enhancement.** *International Journal of Ecology* doi: 10.1155/2012/170931 http://www.hindawi.com/journals/ijeco/2012/170931/

Gaertner, M., Fisher, J.L., Sharma, G.P. & Esler, K.J. (2012). **Insights into invasion and restoration ecology: time to collaborate towards a holistic approach to tackle biological invasions.** *NeoBiota* 12: 57-75. doi: 10.3897/neobiota.12.2123

Gosper, C.R., Yates, C.H., Prober, S.M. & Parsons, B.C. (2012). **Contrasting changes in vegetations structure and diversity with time since fire in two Australian Mediterranean-climate plant communities.** *Austral Ecology* 37: 164-174. doi: 10.1111/j.1442-9993.2011.02259.x

Herrera-Reddy, A.M., Carruthers, R.I. & Mills, N.J. (2012). **Integrated management of Scotch broom (*Cytisus scoparius*) using biological control.** *Invasive Plant Science and Management* 5(1): 69-82. dx.doi.org/10.1614/IPSM-D-11-00048.1

Hosseini Bai, S., Blumfield, T.J., Xu, Z., Chen, C. & Wild, C. (2012). **Soil organic matter dynamics and nitrogen availability in response to site preparation and management during revegetation in tropical Central Queensland.** *Journal of Soils and Sediments* 12(3): 386-395. doi: 10.1007/s11368-011-0466-9

Keogh, R. (2012). **An invasive risk assessment framework for new animal and plant-based production industries.** ISBN: 978-1-74254-320-8

Meunier, G. & Lavoie, C. (2012). **Roads as corridors for invasive plant species: new evidence from smooth bedstraw (*Galium mollugo*).** *Invasive Plant Science and Management* 5(1):92-100. dx.doi.org/10.1614/IPSM-D-11-00049.1

Moir, M.L., Besk, P.A., Brennan, K.E.C., Poulin, R., Hughes, L., Keith, D.A., McCarthy, M.A. & Coates, D.J. (2012). **Considering extinction of dependent species during translocation, ex situ conservation, and assisted migration of threatened hosts.** *Conservation Biology* 26(2): 199-207. DOI: 10.0000/j.1523-1739.2012.01826x

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Petty, A.M. Setterfield, S.A., Ferdinands, K.B. &Barrow, P. (2012). **Inferring habitat suitability and spread patterns from large-scale distributions of an exotic invasive pasture grass in north Australia.** *Journal of Applied Ecology* DOI: 10.1111/j.1365-2664.2012.02128.x

Sheean, V.A., Manning, A.D. & Lindenmayer, D.B. (2012). **An assessment of scientific approaches towards species relocations in Australia.** *Austral Ecology* 37: 204-215. doi: 10.0000/j.1442-9993.2011.02264.x

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Vranckx, G., Jacquemyn, H., Muys, B & Honnay, O. (2012). **Meta-Analysis of susceptibility of woody plants to loss of genetic diversity through habitat fragmentation.** *Conservation Biology* 26(2): 228-237. DOI: 10.0000/j.1523-1739.2011.01778.x

Williams, P.R., Parsons, M., Jensen, R. & Tran, C. (2012). **Mechanisms of rainforest persistence and recruitment in frequently burnt wet tropical eucalypt forests.** *Austral Ecology* 37: 268-275. doi: 10.1111/j.1442.9993.2011.02271.x

Zhang, R., Gallagher, R. S. and Shea, K. (2012). **Maternal warming affects early life stages of an invasive thistle.** *Plant Biology* doi: 10.1111/j.1438-8677.2011.00561.x

Contributions to Research Roundup are welcome, and should be sent to Kirsten Cowley at the above email address using an email subject heading "APC Research Roundup" or similar. Their inclusion will be subject to available space.

ANPC Corporate Members

ANPC gratefully acknowledges the support of the following corporate members

Albury Botanic Gardens, NSW

Australian National Botanic Gardens, ACT

Botanic Gardens of Adelaide, SA

Centre for Australian National Biodiversity & Research

Department of Environment and Conservation, WA

Department of Primary Industry, NSW

Environmental Assessment Branch, Department of Sustainability, Environment, Water, Population and Communities

Heritage and Wildlife Division, Department of Sustainability, Environment, Water, Population and Communities

Mackay Regional Botanic Gardens, QLD

Murrumbidgee Catchment Management Authority

Royal Botanic Gardens and Domain Trust, NSW

Royal Botanic Gardens Melbourne, VIC

Royal Tasmanian Botanical Gardens, TAS

Sydney Olympic Park Authority, NSW

University of Melbourne, Burnley Campus, VIC

UPCOMING ANPC WORKSHOPS

Jewels in the Landscape

ANPC will be hosting two 'Jewels in the Landscape' workshops in NSW in mid-late September 2012. The first will be in the Upper Hunter region. These two day workshops will each provide training in managing significant native vegetation remnants, including travelling stock reserves, road easements and adjacent private land.

These workshops will be followed by a 2 day workshop on plant identification in Grassy woodland remnants.

Plant identification lesson at South Guyra TSR during a 2011 Jewels in the Landscape workshop.

For more details on any of these workshops and to be notified when registrations open please subscribe to ANPC News.
See page 1 for how to subscribe.

Seed collection, storage and use for native vegetation restoration

5th November 2012, The Australian Botanic Garden, Mount Annan, NSW

This one day workshop will focus on the collection, management & use of seed for native vegetation restoration. The workshop is based on ANPC's Germplasm Conservation Guidelines.

Topics will include: developing a collection strategy; seed collection methods; phytosanitary & biosecurity; ex situ storage & establishing a regional seed bank; seed germination & dormancy; & establishing seed orchards. Local case studies & a seed collection field activity will be included.

Translocation of Threatened Flora

6th & 7th November 2012, The Australian Botanic Garden, Mount Annan, NSW

ANPC's successful Translocation Workshop will be held immediately after the Seed Use for Native vegetation Restoration Workshop, making it easy for people to attend both.

Day 1 includes theory and case study presentations from authors of the ANPC Guidelines for the Translocation of Threatened Plants and other translocation experts. Day 2 is an optional field trip to a range of translocation recipient sites and the NSW Seedbank facilities

Viewing a translocated population of the endangered shrub Muehlenbeckia Tuggeranong at a previous ANPC Translocation workshop.

Australian Network for Plant Conservation Inc (ANPC)

9TH NATIONAL CONFERENCE

In partnership with the
Australian National Botanic Gardens
21 years collaborating for conservation

AUSTRALIAN NATIONAL
BOTANIC GARDENS

Plant Conservation in Australia: Achievements and Future Directions

Celebrating the ANPC's 21st year

Monday 29 October to Friday 2 November 2012
Canberra ACT

Early bird registration is now open until 24 August 2012, registration closes 12 October 2012

Call for abstracts and proposals for workshops open until 17 August 2012

Conference themes:

- Threats
- Conservation policy
- Plant Conservation strategies
- Vegetation, soil and water context
- Ecological restoration
- Role of the NGO sector

For an explanation of the conference themes and further information about the conference go our website www.anpc.asn.au

Photos (top to bottom): *Dendrobium phalaenopsis*; *Anigozanthos manglesii*; *Epacris impressa*; *Telopea speciosissima*; *Eucalyptus globulus*; *Gossypium sturtianum*; *Wahlenbergia gloriosa*; *Swainsona formosa*. Photos: APII M.Fagg